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RUAKURA PIG-RAISING INVESTIGATION.

REPORT ON CONSIGNMENT OF PORKER PIGS.

T. E. RODDA, Manager, Ruakura Farm of Instruction, Hamilton.

AT Ruakura Farm in 1933, for the purpose of obtaining information about the breeds and breed-crosses capable of producing carcasses of suitable type, a number of pigs were bred and raised to porker weights and forwarded as dressed carcasses to England, where they were reported upon by Mr. Jos. B. Swain, of the Empire Pork House, and Mr. H. R. Davidson and Dr. John Hammond, of the School of Agriculture, Cambridge University, England.

No attempt was made in the raising of the pigs to throw light on any aspect of the feeding of pigs.

The pigs utilized, ... e born at various dates from the 22nd May t...

All animals were ... ascertain how they were progressing. The firs... te weight were forwarded on the 3rd Novemb... ezing-works, where they were killed and dress... d placed in the freezing-chamber. The balance were killed and placed in the chamber as they became ready, the last two being killed on the 22nd November. On the 23rd November an examination was made of all the carcasses placed side by side on the rail at Horotiu. All these carcasses, excepting one (a Berkshire - Large White), were graded "prime" quality. Seven carcasses were definitely overweight and could not be included in the number to be forwarded in the trial. A selection was then made of the types we considered most suitable, so as to have four pigs in each pure breed or crossed breeds. Unfortunately, we were unable to get four carcasses for the Berkshire - Large White cross. Two only were included.

No attempt has been made to summarize or condense the overseas reports which are given below, and which are especially informative not only in respect to the comparative figures which they contain, but also in respect to the methods adopted in obtaining the data on which the reports are based.

Because of the comments in the reports regarding the Berkshire pigs, it is of some interest to note these pigs were produced by crossing English Berkshire sows with a Canadian Berkshire boar.

The accompanying photographs valuably supplement the data and findings of the reports.

The following are the particulars of the selected carcasses :—

Breed of Pig.	Tattoo No.	Number in Litter.	Number reared.	Average Weight at Weaning.	Live Weight (Full Fed).	Dressed Weight (Heads on).	Age when killed.	
				lb.	lb.	lb.	Weeks.	Days.
Tamworth × Large White	3	13	12	39·02	125	81	19	1
	4	14	13	33·46	119	77	20	3
	5	13	12	39·02	128	80	19	1
	8	13	12	39·02	119	76	19	1
Tamworth × Berkshire	17	14	13	37·2	115	77	18	5
	20	13	12	34·6	117	78	19	2
	21	13	12	34·6	·119	77	19	2
	30	13	12	34·6	113	75	19	6
Berkshire	12	8	4	26·4	113	77	24	2
	26	11	10	39·22	115	76	20	1
	31	11	10	39·22	117	73	21	2
	32	11	10	39·22	114	73	21	2
	14	6	5	43·50	118	73	18	6
Large White	15	6	5	43·50	123	80	18	6
	16	6	5	43·50	120	78	18	6
	19	6	5	43·50	119	74	18	6
Berkshire × Large White	27	9	8	31·03	116	75	21	2
	29	9	8	31·03	115	75	21	6
Totals ..	..	..	..	..	2,125	1,375	..	

Report of Mr. Jos. B. Swain.

A considerable variation is noticeable in the marks awarded to each group of pigs, and it is interesting to note the Berkshire should have gained the largest average number of marks, although they are closely followed by the Berkshire - Large White cross. (Table 1 contains detailed data.)

In view of the conformation of the purebred Berkshire, it would be interesting to know if they are from a Canadian strain, as they do not appear to follow the usual contour of the English Berkshire. Carasss No. 12 is a very good type, although the legs are too long, and the hams tend to fall away, and the carcass is slightly wrinkled. Although great improvement is noticeable in the finishing and de-hairing of pigs of this colour, great care must still be exercised if they are to compete successfully with a White pig.

The pure Large Whites are not very satisfactory, except for No. 14, which could have done with better legs, hams, and belly, neither were the Tamworth-Berkshires very satisfactory. Curiously enough, while I have been writing this report I have had a visit from an Australian farmer (New South Wales) who is using a (Canadian) Berkshire × Tamworth cross, using the Tamworth boar, and he said he was getting good results.

By incorporating the legs in the photographs, much useful information can be obtained about the surplus fat on some of these ...ses compared with the amount of meat.

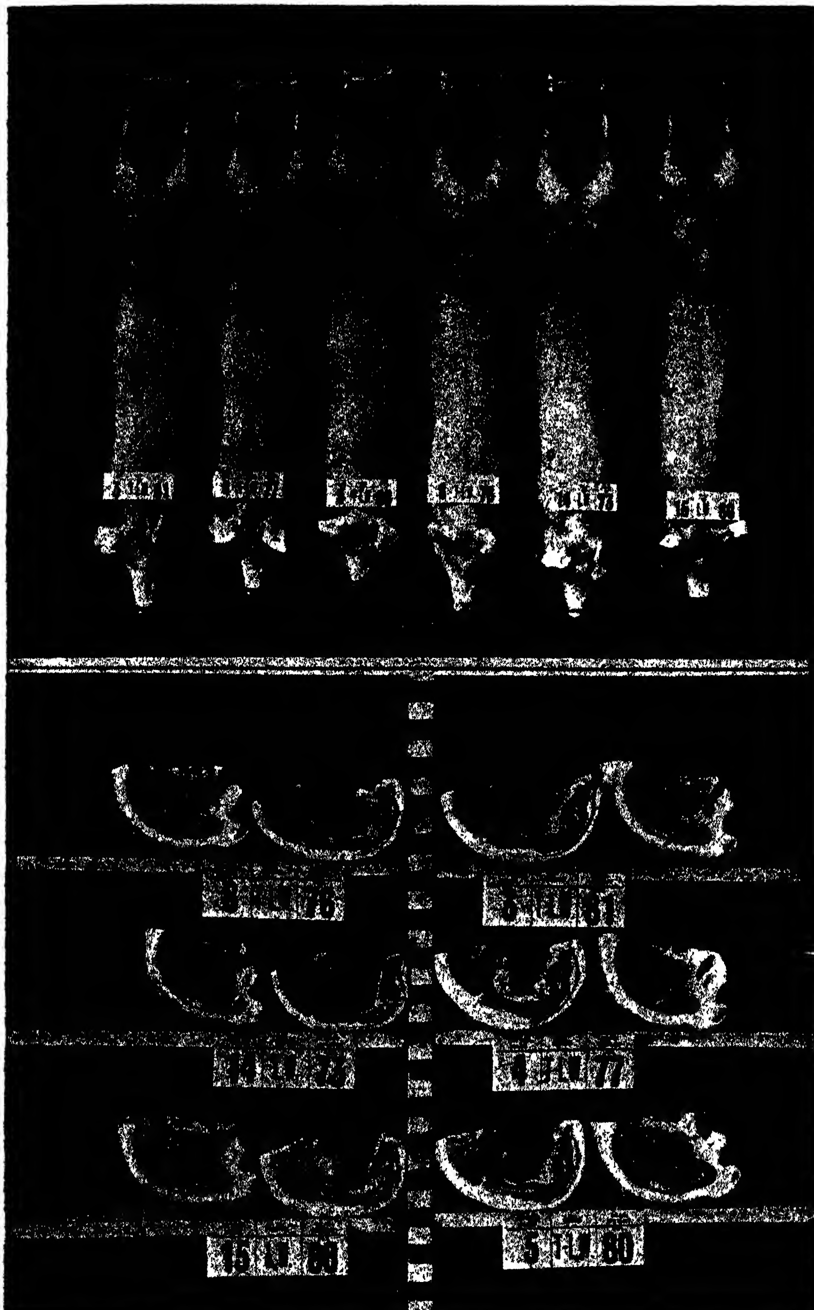


Table 1.

Points and Requirements.	Maximum Marks.	Tamworth × Large White.				Large White.				Tamworth × Berkshire.				Berkshire.				Berkshire × Large White.	
..ass number	..	3.	4.	5.	8.	14.	15.	16.	19.	17.	20.	21.	30.	12.	26.	31.	32.	27.	29.
Carcass weight (in pounds)	..	81	77	80	76	73	80	78	74	77	78	77	75	77	76	73	73	75	75
A. Dressing and general appearance, including finish— Long-bodied, clean, well dehaired, white-finished carcasses Thin skin	15	6	6	8	6	10	8	8	6	8	10	9	8	7	7	9	10	7	8
B. Hind-leg bone— Length from aitch-bone to foot, in inches	8	19⅞	19⅛	19¼	19½	20	19½	19⅛	19⅜	18¼	18⅛	16¾	18	19	17⅝	17⅛	17 13/16	18¾	17⅞
		6	6	6	5	5	6	6	5	7	7	7	6	6	7	7	7	6	7
Length per pound of carcass, in inches (expressed in decimals)		·245	·248	·240	·256	·274	·244	·245	·261	·237	·232	·217	·240	·245	·231	·234	·244	·250	·238
C. Hams— Well-rounded and well-covered with fat .	9	4	4	5	4	6	7	7	5	7	8	8	8	6	8	8	6	6	7
D. Loin— 1. Length from aitch-bone to first rib, in inches	10	29⅞	29⅜	29¾	29⅞	29 15/16	29⅝	29⅛	29¾	28¼	28⅜	28¼	28⅝	28¾	28	27¾	27¾	30	27⅞
		7	7	7	8	9	7	7	8	6	6	6	7	7	6	5	5	8	6
Length per pound of carcass in inches (expressed in decimals)		·368	·381	·371	·393	·410	·370	·373	·402	·367	·363	·367	·381	·373	·368	·380	·380	·400	·388
2. Large eye of meat	12	4	3	5	6	9	5	10	5	7	6	8	8	11	9	8	10	7	7
3. Covering of fat on loin near kidney 60–80 lb., ¾ in.; 81–100 lb., 7/16 in.; 101–120 lb., ⅜ in.	13	⅝	¾	9/16	7/16	⅜	½	15/32	7/16	9/16	⅝	9/16	½	⅜	15/32	7/16	7/16	11/32	15/32
		5	3	6	11	12	7	8	10	6	4	6	7	13	8	10	10	12	8

Table 1—continued.

Points and Requirements.	Maximum Marks.	Tamworth × Large White.				Large White.				Tamworth × Berkshire.				Berkshire.				Berkshire × Large White.	
Carcass number	..	3.	4.	5.	8.	14.	15.	16.	19.	17.	20.	21.	30.	12.	26.	31.	32	27.	29.
Carcass weight (in pounds)	..	81	77	80	76	73	80	78	74	77	78	77	75	77	76	73	73	75	75
E. Belly— Compact, not too much leaf, well streaked with lean, reasonable proportion of fat	15	12	6	10	10	6	11	8	9	8	7	9	9	11	9	9	10	10	10
F. Shoulder— Compact blade-bone well set in, the whole tapering towards small neck. Meaty hand with fine short bone	13	9	4	9	6	9	9	9	10	7	5	8	9	11	9	8	10	10	8
G. Head— Small in size in proportion to size of carcass	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total	100	57	43	60	60	70	64	67	62	60	57	65	66	76	67	68	72	70	65
Average marks	..	55				$64\frac{3}{4}$				62				$70\frac{3}{4}$				$67\frac{1}{2}$	

REPORT BY H. R. DAVIDSON, ESQ., M.A., AND DR. JOHN HAMMOND, F.R.S., OF THE SCHOOL OF AGRICULTURE, CAMBRIDGE.

H. R. Davidson, Esq., M.A.—These eighteen carcasses were examined in Smithfield Market on the 9th March, 1934, and graded on the same basis as previously. No records were available of weaning figures, age, or food consumption. With the exception of No. 4, which was too fat and at the same time underdeveloped in the lean, and possibly of No. 27, which seemed to be slightly abnormal in conformation, the carcasses were all very good indeed, and nearly all superior to prize-winning entries in carcass shows in this country. The remaining pigs graded second class were so placed after very close examination.

As the weights varied only from 73 lb. to 81 lb., it was possible to make close and useful comparisons on a breed basis, this being the only factor on which information was available. While only a very small number of animals is involved in each breed or cross, the differences may be useful for comparison with other results. Only measurements have been used in the following analysis, but a comparison of the photographs with the grades given on eye inspection will show that the measurements are almost always in accord.

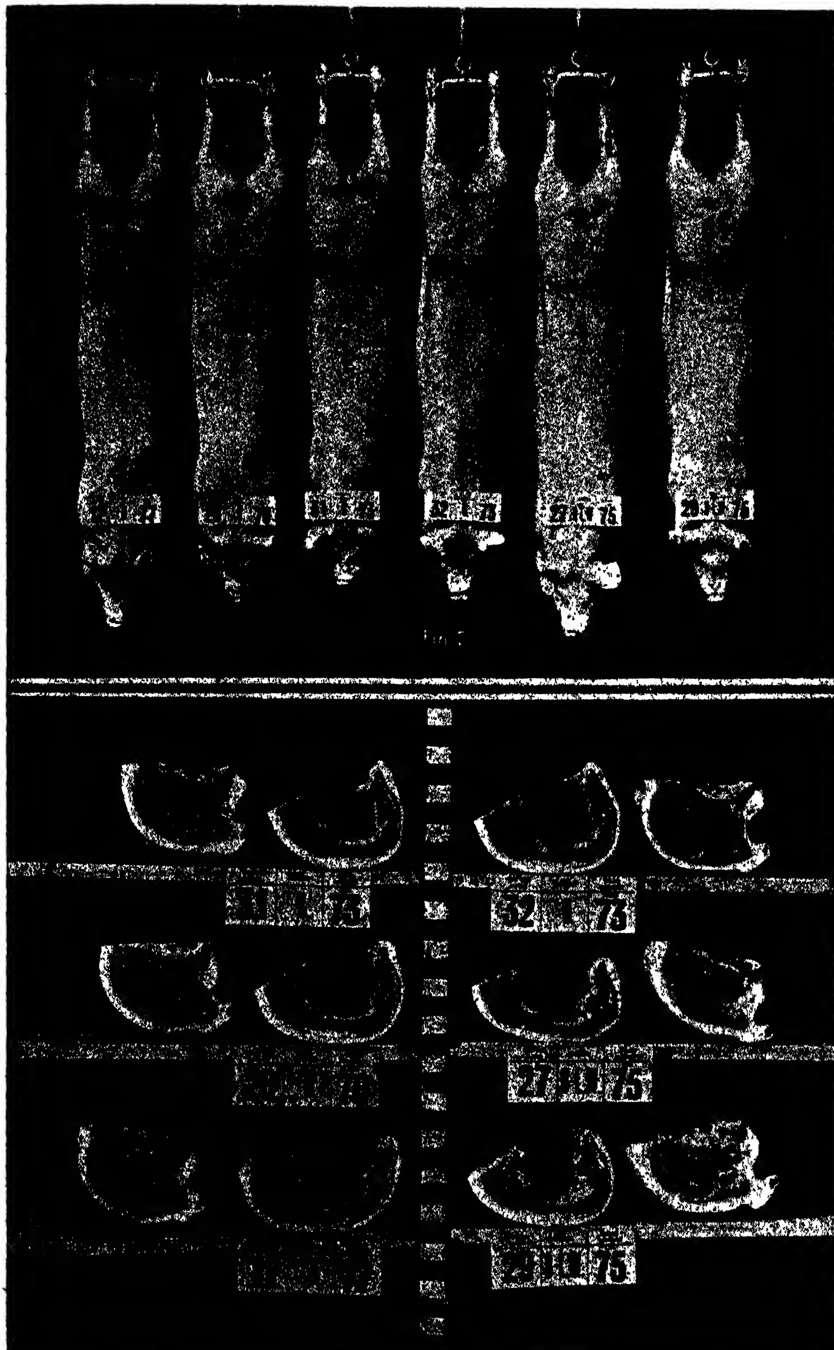
Of the four measurements taken, one, the thickness of the back fat, has an optimum dimension, and so is difficult to use for comparative purposes. In the case of the other three, however, quality may be considered as improving according as the dimension increases or decreases without limit. These are the length of back, length of fore foot (trotter) and thickness of loin muscle. In the table they are first of all compared on a standard basis of 100 lb. carcass weight, and then their relationships to each other are set out.

The figures used (Table 2) are the weighted averages for all the individuals in each breed or cross.

Table 2.

—	Tamworth × Large White.	Large White.	Tamworth × Berkshire.	Berkshire.	Berkshire × Large White
$\frac{\text{Length}}{\text{Weight}} \times 100$ ..	33·0 in.	34·6 in.	32·9 in	33·5 in	35·2 in.
$\frac{\text{Forefoot}}{\text{Weight}} \times 100$ ..	5·04 in.	5·10 in.	4·77 in	4·82 in	5·27 in.
$\frac{\text{Loin muscle}}{\text{Weight}} \times 100$ ..	1·93 in.	2·14 in.	2·22 in	2·40 in.	2·02 in.
$\frac{\text{Average length to weight}}{\text{Average trotter to weight}}$	6·55	6·79	6·89	6·95	6·67
$\frac{\text{Average length to weight}}{\text{Average loin muscle to weight}}$	17·2	16·3	14·8	14·0	17·4

From this it will be seen that four Berkshire pigs are on the whole superior to the others, and they are so because they lack those faults which are typically associated with the breed in this country. Probably the shortest breed in Great Britain, they are only third out of five groups as regards length. Then while in this country they are often ...h too fat, the only one (No. 12) to be faulted in grading on this



occasion is actually too lean. The proportionate length of the trotter to weight is recognized as being an index of early maturity, and in this respect the Berkshire pigs come second in the list. Early maturity, however, is often also associated with early fattening and for small London pork this is to be avoided. The Tamworth-Berkshire cross pigs have the shortest trotters, but they have more fat and less lean. They are also noticeably short in comparison with the other groups, having the poorest figure of all five in this respect. When, therefore, one takes the ratio of trotter length per 100 lb. to length per 100 lb., it is found that the Berkshire comes out top. That is to say, that they combine the length of back required with the early maturing properties which are usually associated with shortness of body. Of still greater interest is the comparison of loin muscle per 100 lb. to length per 100 lb. because the loin-muscle measurement is the true commercial index of early maturity. Here again the Berkshire is first, but while its superiority in the case of trotter to length is only 1 per cent., it is, in the case of loin muscle to length, in the neighbourhood of 6 per cent.

On the other hand, the Tamworths involved do not come well out of the investigation. While they have, when crossed either with the Berkshire or Large Whites, noticably reduced the proportion of trotter, they have also still more reduced the length. In this case the reduction of trotter has not been accompanied by a commercial form of early maturity for the measurement of loin muscle has been considerably reduced as well, and the proportion of this to length is poorer than in the pure breeds.

The two pigs of the Berkshire - Large White cross have not given good results, but No. 27 does not seem to be a very typical pig, and it is hardly fair to draw conclusions from so small a number.

As regards the grading generally, the following suggestions occur :—

No. 4 : Probably a bad type of pig (a genetic factor). The lean is underdeveloped, yet the large amount of fat shows that there has been no unthriftiness.

No. 14 : A good pig killed just a little too light. While the Large White can make very good pork, it should usually be killed a trifle heavier than the other breeds.

No. 19 : The same remarks apply here. Both of these pigs are 73 lb., the lowest in the weight range, whereas they ought to have been killed at about 81 lb., the weight of No. 3.

No. 12 : This is a somewhat peculiar type, being almost a rangy type of Berkshire with very small fat development.

No. 27 : A cross pig with the faults of both parents rather than their virtues. This is one of the great dangers of cross-breeding not always fully appreciated.

Dr. John Hammond, F.R.S.—They were all good and criticism only is directed to finer points of production to differentiate between the carcasses.

They were remarkable for the thickness of lean meat on the loin.

The sets seem to show that first-class porkers can be produced from almost any breed or cross provided the feeding is right—as was the case with these, for they were almost all well developed in the lean ...t and had the right proportion of fat.

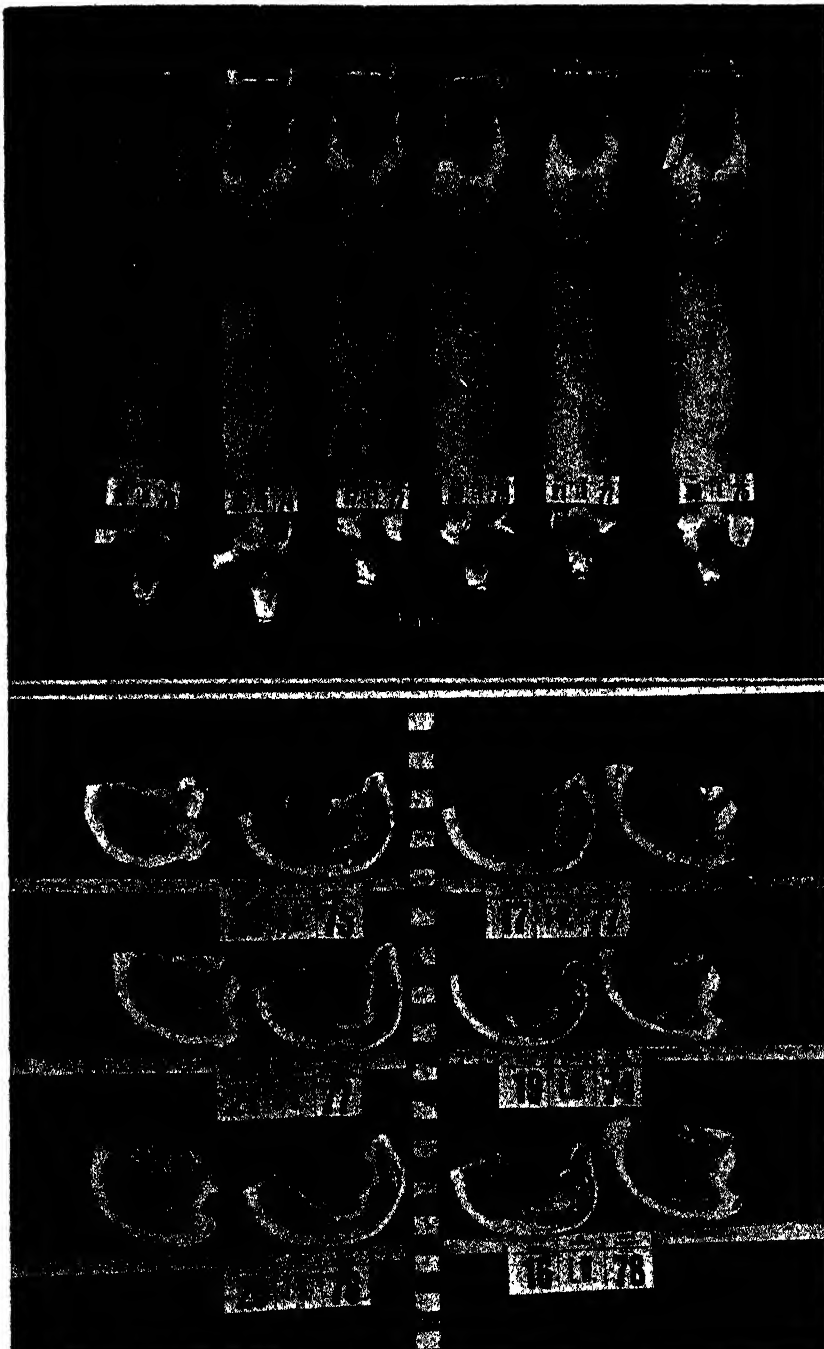


Table 3.—Report on Eighteen Porker Pigs from Ruakura Government Farm.

nark	3.	4.	5.	8.	14.	15.	12.	26.	31.	32.	27.	29.	16.	19.	17.	20.	21.	30.
.. ..	T. × L.W.	T. × L.W.	T. × L.W.	T. × L.W.	L.W.	L.W.	B.	B.	B.	B.	B. × L.W.	B. × L.W.	L.W.	L.W.	T. × B.	T. × B.	T. × B.	T. × B.
ight (pounds) ..	81	77	80	76	73	80	77	76	73	73	75	75	78	74	77	78	77	75
Conformation (Ideal, Very Good, Good, Fair, or Poor)	V.G.	V.G.	V G.	V.G.	G.	V.G.	G.	V.G.	G.	G.	G.	V.G.	V.G.	G.	G.	G.	G.	G.
Back—																		
Amount of fat: 2nd grade (rather fat or lean)	1	2 (fat)	1	1	2 (lean)	1	1	1	1	1	2	1	1	2	1	1	1	1
Eye of loin: 2nd grade	2	2	1	2	1	1	1	1	1	1	2	2	1	2	1	1	1	1
Streak—																		
Thickness: 2nd grade	1	1	1	1	2 (lean)	1	1	1	1	1	1	1	1	2	1	1	1	1
Composition: 2nd grade (rather fat or lean)	1	2 (fat)	1	1	2 (lean)	1	2 (lean)	1	1	1	2 (lean)	1	2 (lean)	2 (lean)	1	2 (fat)	1	1
Legs: 2nd grade ..	2	2	1	1	1	1	1	1	1	1	2	2	1	2	1	1	1	1
Final grade	1	2	1	1	2	1	2	1	1	1	2	1	1	2	1	1	1	1
Measurements—																		
Length of forefoot (centimetres)	10·5	9·8	9·7	10·2	10·3	9·8	9·2	8·7	9·5	9·2	1·00	1·01	9·5	1·00	9·5	9·2	9·1	9·5
Length of back (inches)	26·2	25·6	25 8	26·0	26·6	26·6	25·4	25·4	24·6	24·8	27·4	25·4	25·2	27·0	25·2	25·2	25·4	25·2
Thickness of back fat (centimetres)	1·6	2·1	1·6	1·5	1·1	1·5	1·3	1·5	1·4	1·3	1·2	1·4	1·5	1·3	1·6	1·9	1·6	1·6
Thickness of loin muscle (centimetres)	4·0	3·5	4·1	3·8	4·0	4·3	4·8	4·6	4·3	4·5	3·8	3·7	5·3	3·3	4·2	4·4	4·5	4·3
Ratio— Length in inches / 100 × Weight in pounds	32·4	33·2	32·3	34·2	36·4	33·3	33·0	33·4	33 7	34·0	36·5	33·9	32·3	36·5	32·7	32·3	33·0	33·6
Ratio— Trotter length (inches) / Weight (pounds)	5·10	5·00	4·78	5·29	5·55	4·81	4·70	4·50	5·12	4·96	5·23	5·31	4·80	5·31	4·86	4·64	4·65	4·98

Perhaps the exception to the above is in the external conformation of the ham, which is better in the Berkshire and Berkshire crosses than it is in the others, at these weights—although at heavier weights they would no doubt have lacked the length of back which is seen in the other breeds.

The Large White (No. 16) which was better in the external conformation of the leg was quite equal to the Berkshire and the Large White could be improved for porkers *at this weight* by paying attention to the point.

We unanimously place the five different breeds and crosses in the following order :—

(1) Berkshire.
(2) Tamworth × Berkshire.
(3) Large White.
(4) Tamworth × Large White.
(5) Berkshire × Large White.

NOTE.—The uniformity of the Berkshire group was spoilt by one pig (No. 12), but on the whole this group was the best.

SPECIAL NOTE ON PIG NO. 12.

In the reports from overseas there seems to be some discrepancy of opinion relative to pig No. 12. This pig was placed first by Mr. Jos. B. Swain, who says " Carcass No. 12 is a very good type, although the legs are too long and the hams tend to fall away and the carcass is slightly wrinkled." On the other hand, Messrs. Davidson and Hammond say this pig is too lean and " This is a somewhat peculiar type, being almost a rangy type of Berkshire with a very small fat development."

In view of these two opinions, the following comment was obtained from prominent representatives of the New Zealand pig industry :—

Mr. J. A. Russell, Gillespie's Line, Palmerston North, says " From a breeder's viewpoint, No. 12 on appearance shows lack of meat in twist and would be improved if fuller in the loin and of better finish at the elbow. There does not seem to be the depth of meat through the ham that I as a breeder would like to see. The cuts indicate a wonderful development of meat especially in the flank, and this has led to the prominent place given by Mr. Swain. This placing seems to contradict the former comment, but really it does not ; it strikingly provides a valuable illustration of the advisability of breeders paying more attention to the cuts—attention which marketing requirements will make essential with further development of the export trade. Breeders will have to adopt a system of breeding which will fix the type required to provide the suitable cuts."

Mr. C. Hausmann, managing director of the Fielding Bacon Co., Ltd., says,—

" With regard to the photographs of the porkers which were shown at Smithfield, and judged by Mr. J. B. Swain, and also the comments made by Messrs. Davidson and Hammond, I quite concur with Mr. Swain's remarks. In view of the fact that the legs are lengthy, the hams lacking finish, and a marked wrinkle displayed on the carcass, a little more finish was necessary to bring them to what one might term a state of perfection, but there would still be an element of danger that the cross-sections, as shown in the lower photographs, would in all probability have shown excessive fat. In my opinion, the right carcass has been chosen for that of first

VINES FOR THE HOME GARDEN.

HOW TO PLANT THEM.

J. C. WOODFIN, Vine and Wine Instructor.

THE planting of grape-vines in New Zealand and the consumption of grapes could very beneficially be increased. This article deals with the planting of table-grape varieties in the domestic garden or the home vineyard.

A few vines to supply the household with table grapes can be grown in almost any garden which has a well-drained soil and which receives plenty of sunshine, and no very special knowledge is necessary to do this. Many people think that grape-vines are difficult to grow, or that the vine requires a hot climate or a glasshouse to ripen its fruit in. Actually grapes grow to perfection in temperate climates, and among the 5,000-odd varieties there are some that will ripen in almost any sunny spot in New Zealand.

TIME OF PLANTING.

The usual time for planting vines outdoors in New Zealand is during the month of August. There are two periods during which both vines and vine-cuttings can be planted successfully. In open well-drained soils it is an advantage to plant them in the autumn, when the vines are losing their leaves; they will then start forming roots almost at once, and be in good condition to make an early start in the spring. On soils that are liable to be wet in the winter, the vines and cuttings should be planted in the spring, when the ground begins to become warm again.

USE OF SUITABLE STOCKS.

In Auckland City and throughout the Auckland Peninsula it is essential to plant vines that have been grafted on Phylloxera-resistant stocks, as this destructive insect is spread over most of that part of the country. In fact, as the insect is liable to spread southwards it is a useful precaution to plant vines on resistant stocks in adjoining districts. The outlay for grafted vines is, of course, considerably greater than for cuttings. Grafting vines on suitable stocks improves the setting of shy-setting varieties and increases the crops of most varieties. It is important, however, that the right stocks should be selected. They should have perfect affinity for the scion or fruiting part of the vine and be adapted to the soil conditions of the district in which they are to be planted. There are a number of stocks in use, all of American origin, and they differ, some of them very considerably, in their individual soil requirements.

SELECTION AND PREPARATION OF LAND.

Table grapes can be grown successfully on flat land if it is well drained, and as size and appearance are generally demanded the soil may be richer than that required for wine grapes. Soils rich in food for grapes are not necessarily those which are considered rich for general cropping purposes, as a survey of the actual vineyards in this

country would prove. A poor soil to which the lacking constituents can be added is better than an over-rich soil for vines. The most important centre of table-grape production in New Zealand is in the Waikato, at Te Kauwhata, where the vines are grown on a stiff clay with very little top soil, but, notwithstanding these conditions, the vines produce heavy crops of handsome and luscious fruit, the result of sunshine and careful treatment, for no fruit responds to careful treatment so well as the grape.

Where there is a choice of situation, a gentle slope facing the north-east, north, or north-west should be preferred, in that order, for planting the vines, and if they are being planted in rows the rows should run from north to south where the lay of the land permits.

Before planting the vines the soil should be thoroughly worked, so that the roots will be free to spread rapidly through the soil in all directions. When the roots have started to grow, deep cultivation should be abandoned, as it would destroy the roots and rootlets, which in New Zealand are generally to be found within a few inches of the surface.

On compact subsoils having little topsoil the topsoil should be turned to a depth of 8 in. to 10 in. and the plough followed along the furrow by another plough without a mould-board to subsoil it another 4 in., or one plough with a subsoiling attachment may be used. Where the soil is of the same quality to some depth and is well drained, a deep ploughing will suffice.

When the ground is covered in grass it should be skim ploughed in the autumn, and ploughed deeply across the direction of the skim furrows in early spring before the final cultivation.

It will give the vines a good start and feed them for some time afterwards if about 5 cwt. or 6 cwt. of bone-meal per acre, or 2 oz. per square yard, is applied to the surface soil before turning it in. No other manure should be applied when planting.

Vine-roots develop best in newly-turned-in surface soil, and for this reason it is preferable to plough a couple of inches more deeply than it is intended to plant the vines. After ploughing, the ground should be worked to a fine tilth as it is for sowing cereal crops. The same principles which apply to ploughing apply also to spade work in the garden. In soils lacking in humus, blue lupin may be sown in the year preceding planting at the rate of 100 lb. of seed, with 1 cwt. of superphosphate, to the acre, and turned in when in flower.

PLANTING.

For single vines a hole a yard in diameter and 1 ft. deep should be dug out and the bottom filled with a mixture of topsoil and bone-meal.

If it is intended to plant cuttings, these should be selected from medium-sized, well-ripened canes of the season's growth, discarding the immature wood from the thin ends. A single eye cut with ½ in. of wood, placed in the soil like a seed, will grow into a vine if the soil is kept moist; but for general planting it is usual to cut lengths of cane from 6 in. to 10 in. long, though cuttings of a foot or even 18 in. long may be required in very open or gravelly soils liable t

dry out to a considerable depth in the summer. If the cuttings are to be planted in the spring, the wood can be left entire and buried in dry sand in a cool sheltered place until wanted for planting, when it should be cut into suitable lengths and placed upright in water for forty-eight hours before planting. This same treatment is applied to both cuttings and rootlings received from outside sources. When not required for immediate planting the cuttings or rootlings should be buried under a little moist soil in a shady spot.

To prepare vine cuttings for planting the bottom node or joint is cut through below the bulge, and 2 in. of wood left above the top

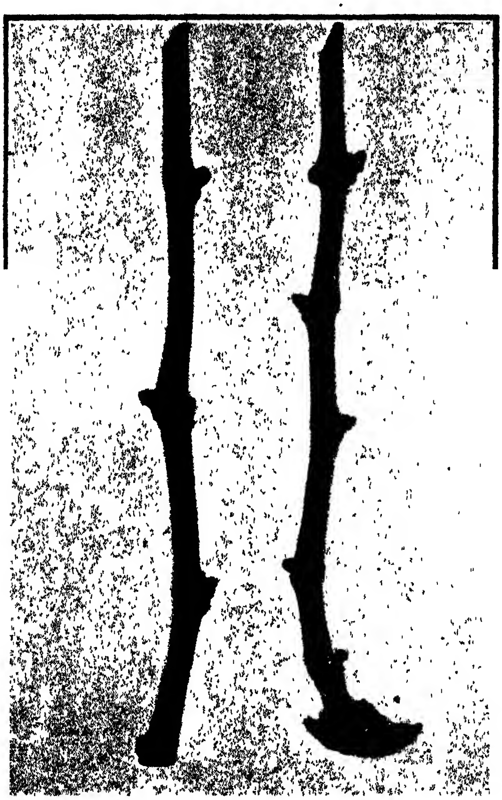


FIG. 1. VINE CUTTINGS PREPARED FOR PLANTING.

node. Most of the roots will grow from the bottom of the cuttings. Any found growing within 3 in. or 4 in. of the surface should be cut off close to the stem during the two winters following planting.

The cuttings can be planted either directly in permanent position or in a nursery about 4 in. apart; in either case extra cuttings should be planted to replace failures.

To plant vine-cuttings in prepared ground a hole should be made for each with a dibble or crowbar, and the cuttings inserted so that the top bud is level with the surface of the soil. Then insert the

dibble in a slanting direction towards the foot of the cutting and lift the earth towards it. Repeat this operation from two other points. It is essential that no air spaces should be left round the cutting, as moulds are apt to form in them and cause decay. When the soil is dry, water poured into the hole containing the cuttings will moisten

FIG. 2. A CLEFT-GRAFTED VINE ROOTLING BEFORE TRIMMING PREVIOUS TO PLANTING.

FIG. 3. THE SAME VINE AS IN FIG. 2, TRIMMED.

the soil and at the same time help to pack it. Now place a 2 ft. stick about 9 in. in the ground to act as a support to the young vine, and form a mound of friable soil to cover the 2 in. of wood above the bud. This will retard the growth from the bud, which is liable to get ahead of the root growth and dry out the cutting before the roots can supply any sap.

In choosing grafted rootlings care should be taken to select only those with perfect unions. A flaw in the union permits soil bacteria and fungi to enter into and eventually destroy the vines, often after five or six years' apparently healthy growth.

To prepare grafted vines for planting, all shoots except the strongest one are cut off, and that shoot is left intact. This is important. All the roots excepting the bottom ones are then trimmed off, leaving mere stubs of these latter ½ in. in length, and the vines are planted in the same manner as the cuttings, but with the lower extremity of the union 2 in. above the ground-level. The vine is then staked and a mound of earth thrown up to cover the union and 4 in. of the scion above it, so as to allow for the earth settling

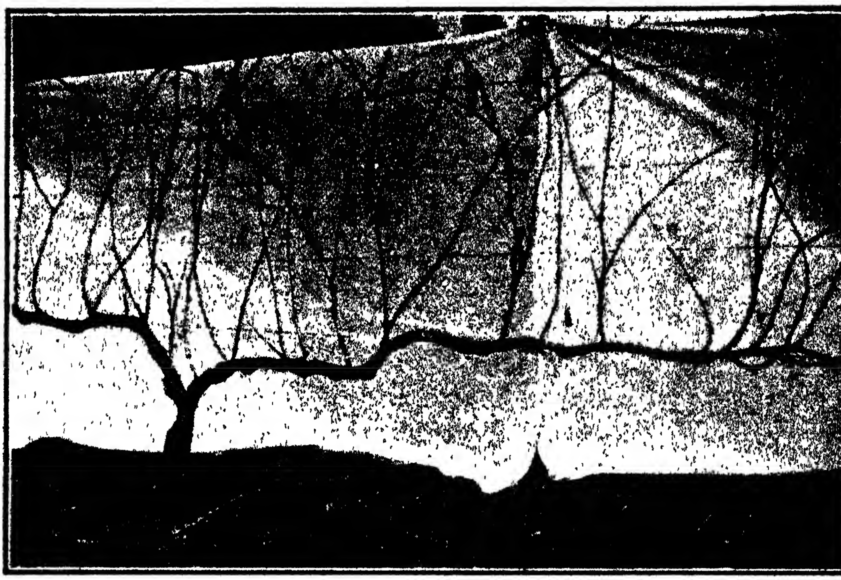


FIG. 4. AN UNPRUNED VINE.

down. The two lower buds on the shoot should be covered with the soil. It is essential that the union should be kept protected from the drying effect of the air until the end of summer.

Care after Planting.

When the leaves on the two or three top buds of the shoot which was left on the vine have opened out, the earth is drawn away and the shoot cut down to one or two buds above the base bud, after which the earth is replaced over the vine. The soil should be kept in good tilth and free from weeds. One shoot only should be allowed to grow, and that secured to the stake, leaving room in the tie to allow the vine to develop. The tender growths of the young vines are very susceptible to fungous diseases, and should be protected accordingly. A special bulletin on the control of vine-diseases is obtainable from the Department.

In the early summer the soil should be drawn away from the unions, and roots on the scions and suckers on the stocks cut away. The soil should be then replaced, to be finally removed when the summer heat is declining.

When the vines are planted in rows, a distance of from 8 ft. to 16 ft., according to the vigour of the variety, is left between the vines, and 6 ft. for hand work, or 8 ft. to 10 ft. to allow for horse or motor power, is left between the rows.

Table-grape vines are generally grown on a trellis, the bottom wire of which is 18 in. above the soil; 12 in. above that wire are two wires 18 in. apart, and 18 in. above these two another single wire. Vines can also be trained over pergolas or against a wall.

Another method is to grow a number of rods from the main stem and support them 2 ft. from the ground on forked sticks.

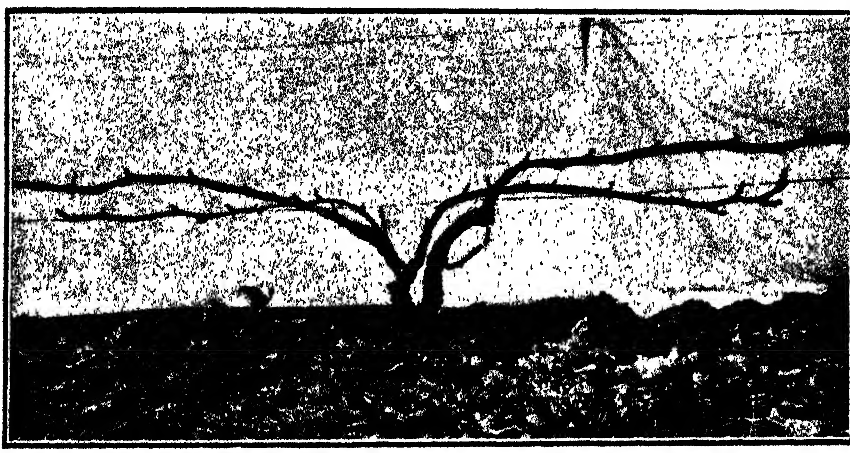


FIG. 5. A SPUR-PRUNED VINE.

SELECTION OF VARIETIES.

In choosing suitable varieties to grow in a particular district the consideration of the latitude is not so important as that of the altitude and aspect. For instance, it has been noticed that certain varieties ripen a fortnight earlier on favourable sites in Central Otago than on less favourable sites in the Wairarapa. In Te Kauwhata, where the principal table grape grown is the Albany Surprise, there is a difference of from three weeks to a month in the ripening of this variety on sites of different aspect.

The vines of the first four periods mentioned below will ripen their grapes in the most southerly parts of the South Island if grown on sites protected from the south and exposed to the sun.

RIPENING PERIODS.

The "first" ripening period is that of the Golden Chasselas (Chasselas doré de Fontainbleau), which ripens in New Zealand about the end of February or the beginning of March, according to the

altitude, aspect, and soil conditions of the vineyard. The "precocious" varieties ripen their fruit from two to three weeks before the Golden Chasselas; "early" varieties between the "precocious" and "first" period varieties; "second" and "third" periods approximately two and four weeks later respectively than the Golden Chasselas.

European Varieties for Outdoor Culture.

The following are the table-grape varieties recommended for outdoor culture in New Zealand:—

Precocious Period.—Black: Gamay hâtif des Vosges; Madeleine Noir. White: Madeleine Alice Salomon; Luliatica Pavese; Moscato Bianco Precocissimo.

Early Period.—Black: Noire hâtif de Marseille. White: Précoce de Malingre; Agostenga.

Early First Period.—Black: Portugais bleu. White: Madeleine Royale; Goldriesling blanc; Chasselas Vibert; Ferdinand de Lesseps.

First Period.—White: Golden Chasselas (Salomon's selection); Sicilien (syn. Panse précoce); Lignan. Rose: Chasselas Rose (Salomon's selection); Chasselas Rose Royale.

Second Period.—Black: Black Hamburg; Muscat Caillaba; Cinsaut (syn. Boudales). White: Bicane (grafted on 34 Ecole); Gradiska; Temprano; Foster's seedling; Muscat de Frontignan; Poulsart blanc; Palomino. Red: Muscat rouge de Madère. Rose: Superbe de Candole.

Late Second Period.—Black: Muscat Hambro (grafted on 34 École). White: Regina.

Third Period.—Black: Black Alicante; Mrs. Pince's Muscat; Gros Maroc;. Malakoff Isjum. White: Golden Queen; Vigne de Michel; Shiradjouli; Blanc de Calabre; Rosaki; Corniola de Milazzo; Muscat of Alexandria. Red: Maraville de Malaga; Red Hanepoot.

American and American-European Varieties.

The pure American varieties and American-European hybrids, being more resistant to diseases, are especially suitable for North Auckland conditions, and as they require less care than the European varieties are very suitable for planting in the farmer's garden or orchard.

Owing to their aromatic flavours, the grapes they bear are not always appreciated by those used to the delicate flavours of the European grapes; but others prefer them, as the already large and increasing demand for the Albany Surprise on the Auckland market and for the Iona in Hawke's Bay goes to prove.

Precocious.—White: Baco 2–16 (Totmur) suitable for pergolas.

Early.—Black: Campbell's Early; Worden. White: Seibel 5279; Diamond.

First Period.—White: Seibel 2653; Seibel 4995; Seibel 5860; Gaillard Girerd 157; Baco 7A.

Late First Period.—Black: Seibel 4643; Seibel 5455. Red: Agawam.

Second Period.—White: Niagara. Black: Albany Surprise—suitable for pergolas; Herbert; Concord; Seibel 5813. Red: Iona; Brighton.

SMALLER COLLECTIONS.

A smaller collection, selected from both European and American varieties, that would supply grapes throughout the season could consist of the following :—

Black : Noir de Marseille ; Portugais bleu ; Black Hamburg ; Muscat Caillaba ; Albany Surprise ; Cinsaut ; Muscat Hambro ; Gros Maroc ; Mrs. Pince's Muscat.

White : Madeleine Alice Salomon ; Madeleine Royale ; Seibel 5279 ; Chasselas Vibert ; Golden Chasselas (Salomon's selection) ; Sicilien ; Seibel 2653 ; Foster's seedling ; Gradiska ; Temprano ; Golden Queen.

Red : Chasselas Rose Royale ; Muscat Rouge de Madère ; Iona ; Red Hanepoot.

A still smaller selection suitable for both home and market purpose could include :—

Black : Portugais bleu ; Seibel 4643 ; Albany Surprise ; Black Hamburg ; Cinsaut.

White : Madeleine Royale ; Seibel 5279 ; Chasselas Vibert ; Seibel 2653 ; Golden Chasselas ; Golden Queen.

Red : Chasselas Rose Royale ; Iona.

A number of recently introduced varieties of American, European, and hybrid vines are under observation in the Government Experimental Vineyard at Te Kauwhata, and will be released during the next and following seasons as they are found to be suitable for New Zealand conditions.

PHYLLOXERA-RESISTANT VINE-STOCKS.

A selection of stocks suitable for the various types of soil in the Phylloxera-infested areas of North Auckland is available. Advice as to their affinity for scion varieties and their adaptation to the different soils will be supplied on application. With a good start rooted vines will produce grapes in the second season after planting, and cuttings in the third season.

Control of Bronze Beetle.—There is a minimum amount of arsenate-of-lead deposit required for effective control of bronze beetle, and investigations with spreaders showed that these materials, while increasing the evenness of the film, were very prone to run too much spray off the fruit. The most effective type of cover that could be secured by spraying was a close " spot " one applied with a fine mist spray using acid arsenate of lead alone. Work with fish-oil and arsenate did not uphold previous results because the oil also ran too much arsenate off the fruit. Paris green gave a better killing effect on the beetle than did the same quantity of arsenate of lead, but the former material is very liable to cause injury. Barium fluosilicate gave approximately the same control as did arsenate of lead, but it too caused severe burning of the fruit. The conclusion reached in this work as far as spraying is concerned is that a good, even " spot " cover of arsenate of lead applied as a mist spray will give a good control, and where the beetle is troublesome it is advisable to endeavour to secure such a cover with 4 lb. of acid arsenate of lead per 100 gallons of spray.—*Report, Entomologist.*

WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

RECORD OF WORK FOR SEASON 1933–1934.

A. STUART, Instructor in Agriculture, Fields Division, Invercargill.

THE 1933–34 season, apart from a dry period of six weeks' duration from the beginning of November, was quite favourable for dairying operations, but until nearing the end of the season the price of cheese was exceptionally low. Butterfat actually sold amounted to 10,682 lb., which is equivalent to a per-acre production of 117·38 lb. From the group herd-testing figures it was ascertained that the 43 cows placed under test averaged 257·51 lb. In comparison with the previous year there has been a big improvement in total production, but it is hoped to obtain a similar improvement in per-cow production, especially as the herd is being reduced to enable some sheep to be carried with profitable results.

ROTATIONAL GRAZING INVESTIGATIONS.

A rotational grazing trial, originally laid down in 1928, was associated with an investigation into the merits or demerits of using continuous applications of sulphate of ammonia in addition to phosphate (see *Journal of Agriculture*, Vol. 41, pp. 407–412, for particulars as to the establishment of this trial). Last season each field which had received the sulphate of ammonia dressings was top-dressed with 2 cwt. per acre of carbonate of lime for each hundredweight of sulphate of ammonia applied between 1928 and 1932.

The records of carrying-capacity during the season were as follow :—

Field.	Cow-days.	Dry-stock Days.	Total.
4A	219·3	91·2	310·5
4B*	175·6	86·8	262·4
Difference ..	..	..	48·1
8A	236·2	115·8	352·0
8B*	180·5	92·2	272·7
Difference ..	..	..	79·3
10A*	277·5	121·4	398·9
10B	241·9	136·1	378·0
Difference ..	..	..	20·9

* Denotes under nitrogen previously.

From the above it will be noted that the carrying on fields 4 and 8 is in favour of no nitrogen, even though the nitrogen fields received

lime at the commencement of the season to correct the acidifying effect of the sulphate of ammonia. These results would indicate a deleterious effect from sulphate of ammonia. In the case of field 10, the difference is in favour of the nitrogen-treated area, but this field was not brought under the scheme until 1931, and is therefore the youngest pasture and thus did not receive a large aggregate dressing of nitrogen as did the older fields. Records will be taken again this season.

At a field-day held on the 16th May, 1934, the farmers present were provided with voting-papers and asked to indicate the best portion of each field. The preference of the majority coincided with that conveyed by the above grazing figures, even to the placing of 10A ahead of 10B.

Grasses and Clover Strain Trials.

The two hundred rye-grass plots in field 7 still present an interesting appearance at all periods of the year, although during the late spring and summer the absence of rye-grass in the false perennial plots is disguised by the prolific growth of volunteer white clover. To throw further light on the relations between persistency and palatability, and to compare the actual carrying-capacity and production of certified versus uncertified rye-grass, one-half of field 6 was laid down in uncertified and one-half in certified rye-grass. The field was sown on 4th October, 1933, with 2 bushels of oats as a nurse crop. Two bushels per acre of rye-grass were used in each case, but the uncertified line comprised a mixture of five commercial strains, which had tested "A3," two "B3," "B3-4," and "B4," under the ultra-violet-light test. In each case 2 lb. per acre of uncertified white clover was also sown. The oat crop was cut on the 20th February, 1934. Fifteen hundred-weight carbonate of lime per acre was applied to each half in May, 1934. Up to the end of June the cow-days per acre were in favour of the uncertified field, and although this was expected, it is interesting to record that at the field day above mentioned preference was expressed in the farmers' voting-papers for the certified portion.

The cocksfoot, red and white clover strain in field 5 was ploughed under this autumn. This trial has, at any rate, raised the question as to whether the inclusion of cocksfoot in a seeds mixture with certified rye-grass for land of good average quality, top-dressed annually, is not a waste of money. It was only for a short time in February that the best strains of cocksfoot showed up to any extent in competition with the strain of rye-grass used in the base mixture.

Rate of Liming Trial.

In Block 13, in which a heavy application of sulphate of ammonia had caused the change of composition of the sward in 1932 from clover to rye-grass dominant, carbonate of lime was applied at 1 ton, 2 tons, and 4 tons per acre. To date no differential results have been noted.

Cruciferous Trials.

In fields 1 and 2, blocks of 1 acre of eight varieties of swedes were grown, being sown down during the last week of November, 1933, the

seed being ridged and fertilized with a mixture of 3 cwt. superphosphate and 3 cwt. carbonate of lime per acre. A dry spell delayed germination some weeks, but from January onwards growth was good. The varieties were weighed up on 14th May, 1934, with the following results:—

Variety.	Yield, in Tons.
New Colossal Tipperary	44·25
Halewood	40·15
World's Best	40·15
Champion Purple Top	40·05
Conqueror	39·35
Superlative	36·75
Monarch	30·00
Magnificent	24·40

Favoured by the slow-growing conditions in the early part of the season, club-root infection was prevalent, particularly in the varieties Monarch, Magnificent, and Superlative—the two former, however, being the only varieties showing serious bulb-infection.

In the same field a small trial of farm seeds was carried out also, sixteen lines being sown with the planet Junior on land pre-ridged and pre-fertilized with the mixture employed in the variety trial. In this case, two points were of interest—the great superiority in growth maintained by the variety Giant Broad Leaf Essex rape over the ordinary Broad Leaf Essex, and the favourable germination and growth of a New-Zealand-grown line of chou moellier in comparison with a commercial imported strain.

Club Root Trials.

In field 9, of the three hundred selected Bruce turnip bulbs transplanted, 132 bulbs were individually harvested. These lines will be sown separately this season in the Dunedin district and the best lines again seeded. It is hoped in this way to secure some choice lines of mother seed. A bulk selection of the Winton line was sown in January with other locally produced lines. A club-root count taken in May showed 9 per cent. of infection in the Winton line compared with 36 per cent. in the control line, consisting of Aberdeen Purple Top. An interesting feature observed was the confirmation of the fact that the Bruce variety does not breed true, as two green-top turnips were produced as the progeny of the selected bulbs.

In field 9 there was also a club-root trial, with twenty-four varieties and strains of swedes and turnips. Germination was delayed by a dry spell and club-root developed seriously. From counts taken on 15th May, 1934, the best varieties from the point of view of resistance to bulb-attack were the Mai turnip, one strain of Bruce ex Aberdeenshire, and a selection of a New-Zealand-raised swede. In passing, it may be mentioned that the Mai is a soft turnip and has proved to be a very low yielder when grown in Southland last year.

Wheat Variety Trial.

On 3rd October, 1933, a wheat variety trial was laid down in collaboration with Dr. O. H. Frankel, of the Wheat Research Institute, Christchurch. The technique employed was on the lines of the small-scale

yield trials at Lincoln, the seed for each plot being weighed out at Lincoln, and sown by hand in rows 12 in. apart. At harvest the heads from each plot were put in bags and railed to Lincoln, where they were threshed and weighed. The procedure proved simple, economical, and comparatively accurate, differences of about 5 per cent. in many cases being statistically significant. An added advantage of the small size of the area was that it made possible the netting of the plots to prevent bird damage, but only five of the ten replications laid down could be protected in this way, owing to shortage of netting. Had the remaining five replications been harvested, the accuracy of the trial doubtless would have been considerably increased. The yields recorded were :—

Variety.	Bushels per Acre.	Percentage of Yield below Solid-straw Tuscan.
S 617 (Portugal 19) ..	54·5	24·6
S 633 (Portugal 27) ..	54·8	24·1
S 662 (Portugal 42) ..	50·5	31·2
S 767 (Portugal 90) ..	54·7	25·3
Marquis	48·8	37·6
Jumbuck	47·2	39·7
Montana King	55·9	28·6

All the varieties show considerably lower yields than Solid-straw Tuscan (24–39 per cent.). It should be noted that the above yields are calculated on the fact that the rows are 12 in. apart, whereas probably the same weight of grain would be produced if the area had been sown in 7 in. drills, as is usual. Thus, the above figures could nearly be doubled. In view of the heavy yields obtained in this trial in comparison with others, further trials will not be conducted at the area, but on ground of lower fertility elsewhere in the district.

The promise of earliness was fulfilled, two to over three weeks' difference in the maturity being obtained between Tuscan and the earlier varieties. The fermentation times (after Pelshenke) of the Portuguese lines was superior to Tuscan, and those of the other varieties very markedly superior. The baking scores supplied by the Wheat Research Institute show that S 617, S 662, S 767, and Montana King were equal to Tuscan, Marquis was slightly superior, and S 633 and Jumbuck very markedly superior.

MISCELLANEOUS.

A small trial which contained twenty-four varieties of wheat was also conducted, to afford material for examination for rust-resistance. Rust developed on eleven varieties only. In April, 1934, an oat-variety trial was laid down. A further series will be spring-sown. In part of field five blue lupins at the rate of two bushels per acre were sown in April, 1934. Grass had been established in this field late in the previous autumn, but the clover had suffered severely from frost-lift. Due to the clover deficiency the grasses had not been vigorous, and the lupin-seed was disked in after being broadcast.

By the end of May the lupins were well established and 5 in. in height, and a noticeable improvement has been wrought in the vigour of the grass sward.

The area was visited by the Prime Minister, the Right Hon. G. W. Forbes, and party, on the 24th January, 1934. He expressed his approval of the work being conducted. In addition to the Government subsidy, material assistance has been forthcoming from the trustees of the R. M. Mackinnon Estate, and appreciation of this aid is gratefully acknowledged by the committee. A change in the managership occurred in July, Mr. G. L. Smart tendering his resignation and being succeeded by Mr. P. McMillan. Through the courtesy of the chairman of the farm committee (Mr. D. H. McLean, of Caroline), a loan of a top-dresser for an indefinite period has been extended to the area and is much appreciated.

TRIAL OF WINTER FORAGE CROPS AT MASSEY AGRICULTURAL COLLEGE.*

A REVIEW OF THE PRODUCTION AND RELATIVE VALUE OF SOME OF THE COMMON PLANTS USED IN 1932 AND 1933 SEASONS.

W. A. JACQUES, Massey Agricultural College.

IN considering the problem of the satisfactory production of winter-grown crops for stock-feeding there are special features, apart from the actual husbandry, which may weigh heavily in their favour when balanced against the cost of producing such crops. The first of these is the problem of winter dairying. There are naturally many farms in New Zealand where winter milking has to be practised to provide a regular supply of raw milk for urban populations, but the problem of the extension of this to include manufacture of dairy-products may sooner or later have to be faced. The Imperial Economic Committee urges that all parts of the Empire pay a greater attention to winter milk-production in order to supply dairy-produce more evenly to the home market. Much has recently been written bearing on various aspects of the problem in New Zealand. It has been suggested authoritatively that it would be advantageous to this Dominion to depart from purely seasonal dairying and practise more uniform production throughout the year. It is stated that it would help to eliminate the excessive accumulation of stocks of New Zealand butter at certain periods and the absence thereof would steady market prices.

Among the most formidable factors which are limiting winter milking at present are the lack of cheap concentrated foods, and an inadequacy of grass growth in the permanent pastures. To overcome these disabilities the production of the required highly nutritious food on the farm must be undertaken. It is impracticable to shut up a large enough area of permanent pasture in early autumn to grow a

* Paper presented at 1934 conference of New Zealand Grassland Association.

reserve of food for the whole winter season. Hay, roots, and silage by themselves are not quite satisfactory for the purpose of maintaining the cows in full production. These foods used alone are too bulky and would make too great a drain on time during the summer in their production and harvesting. The problem then resolves itself into growing a crop on some portion of the farm which (*a*) will grow better than pasture during winter, (*b*) can be grazed during winter, (*c*) will yield well for the full period required a fodder at least equal to grass, and (*d*) repay for the cost of reseeding the area down to permanent pasture.

In order to obtain more information on the relative value of some of the crops widely used for winter grazing, not only by dairy cattle but by also sheep, a series of plots was laid down at Massey College for the winter periods of 1932 and 1933. It is not practicable to cost the crop based on experimental plots, so that this aspect has not been dealt with. The plants tried out include prairie-grass, College and Australian Algerian oats, Italian rye-grass, black skinless barley, Cape barley rye-corn, vetches, and red clover.

The plots were fenced off from the stock and the produce cut periodically with shears, dried, and weighed. Owing to the difficulty of taking herbage samples during winter free from external moisture, and due also to the varying amounts of moisture held by the different plants, it was found necessary to oven-dry the samples. By taking periodic test-samples when the herbage was externally dry it was possible to calculate back to green weight, and the figures given in this paper are for green weights only. In both years the forage crops followed run-out grass and were manured with 2 cwt. superphosphate per acre.

Growth Habit of the Different Plants.

In the first year the crop was sown on the 26th March and on the 6th March in the second year.

The first cutting was made fifty-nine days after sowing, but the prairie-grass and Italian rye-grass were not sufficiently advanced to cut. Where there was an admixture of a cereal and rye-grass, the cereal contributed by far the greater bulk. Where rye-corn and vetches were sown together the greater bulk was given by the latter.

In the first two months all the cereals outyielded Italian rye-grass and prairie-grass, and the red clover yielded nothing.

Recovery after cutting and grazing.

Black skinless barley was outstanding for recovery after the first cutting. Cape barley, though not quite so good in this respect, was better than oats, and rye-corn was also slow. Where these crops were grazed with dairy cattle the black skinless barley was very evenly cropped, and in consequence recovery was even, and the same can be said of the oats and rye-grass. Cape barley, however, was unevenly grazed, and appeared to be less palatable, and there was more waste from trampling. In the second season both barleys were grazed equally by the cattle. The relative lack of palatability of Cape barley was much more evident when the three cereals sown in strips with and without

Italian rye-grass were tried out on a different area under sheep-grazing. The sheep showed a very marked preference for the oats and grazed them bare, then grazed the black barley moderately and without obvious relish, but neglected entirely the Cape barley, which had to be fed off with bullocks.

Three months after sowing the oats were suffering from an attack of "red leaf," and where this was most evident recovery after cutting and subsequent growth were slow. By the 2nd August this infection was at its height, and it was not until early September that the plants were able to overcome it. Vetches made good early growth, but were not extensively grazed, and where grazing did occur their recovery rate was slower than that of the cereals. Prairie-grass was very slow throughout the whole of the period under review, and cannot be regarded as satisfactory when down for only one season.

By mid-August the rye-grass was making headway and was starting into more active growth. The barleys, on the other hand, were falling off in production and were much less leafy. This was particularly marked in the case of the black barley, and Cape barley all through has been the more leafy plant Rye-corn, which was very slow in the early growth stages, only started to produce with the advent of warmer weather. In both seasons its winter production was so poor that no weights were taken. The red clover was not in evidence, and it has so far contributed nothing towards the grazing, and only came into prominence in the late spring

By early September the rye-corn was beginning to get stemmy and was mainly neglected by the cattle and grazed less evenly than the other cereals. The barleys had passed their zenith of growth and were yielding very little. The oats that were free from "red leaf" yielded a good crop and were the most leafy of the cereals. The Italian rye-grass was approaching its best, When cut for silage on 22nd October the cereals were in head, but the rye-corn, which was the most advanced, presented a stemmy and fibrous crop with little leafage and nothing to recommend it for silage purposes. Black barley was less leafy and suffered more from rust than the Cape during the first season, but mildew attacked the Cape and not the black barley in the second year. Oats were the latest and the most leafy of the cereals even though they had been grazed more closely than the others

The vetches, where grazed lightly, continued to thrive and kept up with the cereals in rate of growth, but where they had been cut or grazed more heavily they failed to recover and were disappointing for silage purposes. Italian rye-grass, whether sown alone or with a cereal, was growing strongly and was not far enough advanced in growth when cut to give its best yield of silage. It was only on the plots where rye-grass was sown that weeds were suppressed.

THE SECOND SEASON'S TRIAL.

In the main, the growth features of the plants were the same as in the first season. The incidence of disease, however, affected the oats to a lesser extent and the Cape barley slightly more than in the previous

season. The second season has thus been chosen for a more critical review of the seasonal production The results of the winter of 1933 are as follows :—

Crop.	First Cut. (Cut 26th April, 51 Days after Sowing)	Second Cut (Cut 30th May, 85 Days after Sowing.)	Third Cut. (Cut 18th July, 134 Days after Sowing.)	Fourth Cut (Cut 23rd August, 170 Days after Sowing)	Total (Total Green Weight per Acre of Grazing)	Silage. (Cut 8th November, 247 Days after Sowing.)	Total (Total Green Weight per Acre of Grazing and Silage.)
	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.	T. c.
2½ bushels Algerian oats and ½ bushel winter vetches	2 13	1 2	1 10	1 15	7 9	10 13	18 2
2½ bushels black skinless barley and ½ bushel winter vetches	3 11	1 18	1 4	0 18	7 11	8 13	16 4
2½ bushels Cape barley and ½ bushel winter vetches	3 4	2 2	1 11	1 5	8 2	9 19	18 1
4 bushels Algerian oats* ..	2 13	1 8	2 9	1 15	8 5	8 0	16 5
4 bushels College Algerian oats*	Nil	4 3	1 18	1 9	7 10	10 18	18 8
4 bushels black skinless barley	5 2	1 17	1 4	1 4	9 7	5 8	14 15
4 bushels Cape barley .	3 10	1 14	1 10	1 4	7 18	6 1	13 19
3 bushels Algerian oats and 20 lb. Italian rye-grass	2 3	1 11	2 10	1 9	7 13	11 15	19 8
3 bushels black skinless barley and 20 lb Italian rye grass	4 7	1 12	1 13	0 17	8 9	9 14	18 3
3 bushels Cape barley and 20 lb Italian rye-grass	3 11	1 11	2 4	1 4	8 10	9 17	18 7
3 bushels rye-corn and 20 lb Italian rye-grass†	Nil	2 0	2 13	1 17	6 10	11 13	18 3
40 lb Italian rye-grass ..	Nil	2 6	2 10	1 11	6 13	10 6	16 19
35 lb Italian rye-grass and 5 lb red clover	Nil	1 17	2 10	1 13	6 0	10 17	16 17
40 lb prairie-grass . ..	Nil	0 12	1 10	1 14	4 2	11 0	15 2

* Algerian oats are of Australian origin unless otherwise noted † The rye-corn, both when sown pure and in combination with vetches was so poor that weights were not taken Rye-corn in combination with rye-grass was weighed, but by far the greater bulk represented the rye-grass

Growth Period.

It will be seen from Table 1 that some of the combinations or pure seedings gave heavy yields under a system of cutting comparable to grazing and also gave a satisfactory hay or silage crop. Others again gave either a heavy yield for grazing and little hay or silage or else heavy silage crops with relatively little grazing. The growth-habits can be further analysed according to the period within the winter grazing season at which most growth is recorded. For the purpose of this record five cuttings were made on each of the plots, with the exception of the College Algerians, prairie-grass, Italian rye-grass alone and with red clover and rye-corn. There was insufficient growth to warrant them being cut and weighed on the first cutting date, and, in consequence, the produce of the first two growth periods is recorded in the second.

In addition, the whole field was subsequently cut for hay, but none of the cereals and only the rye-grass, red clover, and prairie grass contributed to it. Weights were not taken, but it is estimated that the

yield of hay was in the vicinity of 1 ton per acre, the prairie-grass giving a somewhat heavier yield than the rye-grass alone and about equivalent to the yield on the rye-grass and red-clover plots.

Seasonal Productivity.

It will be seen from the table that the different grasses and cereals varied considerably in their productivity at the different seasons. The figures represent the weights of green material from the respective plots at the five cuttings. The following points present themselves from an analysis of the yield table.

A CEREAL WITH VETCHES.

Algerian Oats and Vetches gave a moderate initial yield and a slow recovery, after which the yield increased as the winter gave place to spring. The silage crop was not so heavy as where Italian rye-grass replaced the vetches, and was only slightly below that from rye-grass and red clover and from prairie-grass. The amount of winter grazing was better than Italian rye-grass, but below that of the barleys, though the total yield (including the silage crop) was greater in both cases.

Black Skinless Barley and Vetches gave a large initial yield, but production then fell away rapidly, and only a moderate yield of silage was got.

Cape Barley and Vetches gave a smaller initial yield than the black barley and vetches and the subsequent recovery was better, but, unlike the oats, production decreased as the season advanced. Even so, a greater amount of grazing was got from this plot than from the two previous ones, and though the silage crop was smaller than in the case of the oats and vetches the total yield from both mixtures was approximately the same.

A CEREAL WITH ITALIAN RYE-GRASS.

The total yield from mixtures of a cereal with Italian rye-grass was greater than in the corresponding mixtures where vetches were used, but a heavier seeding of the cereal was given.

Algerian Oats and Italian Rye-grass gave a moderate initial yield, consisting mainly of oats, but recovery after the first cut was better than in the case of oats and vetches, and production gradually increased as the season progressed. The final silage crop was the heaviest of any produced, and amounted to 11¾ tons green weight, though the grazing was less than in the case of the barleys with rye-grass. The influence of the rye-grass was becoming apparent in the third cut (mid-July) and assisted substantially in giving the extremely satisfactory yield of silage. As these two plants are slower in maturing than the barleys and rye-corn the cutting date for silage could have been postponed to their advantage.

Black Skinless Barley and Italian Rye-grass gave a very heavy initial growth, but production decreased considerably after the first cut. The Italian rye-grass was at a disadvantage on account of this excessive early competition, and did not properly recover until spring, when it featured very largely in the silage cut. The total yield and

the weight of silage from this combination was higher than from either black barley alone or with vetches. It gave less grazing than the pure sowings, but was better than the barley and vetches.

Cape Barley and Italian Rye-grass also showed to some extent the suppressing effect of rapid early growth of the cereal on the rye-grass. Only in the third cut did the rye-grass add materially to the yield. The yield of grazing and silage differed little from the corresponding black-barley plot, but the grazing was better than for oats and rye-grass, and the silage cut and total yield were less.

Rye-corn and Italian Rye-grass form a poor winter grazing combination. The weight of the silage cut was almost equal to that of oats and rye-grass, but there could be no comparison between them for stock-feeding purposes, the rye-corn being very stemmy and fibrous, while the oats were leafy and more succulent. Thus the oats and rye-grass gave more grazing, as much or more silage, and a better feeding-product. These factors in themselves rule out rye-corn for winter-production purposes.

PURE CEREAL SOWINGS.

Algerian Oats.—The Australian seed was earlier in growth than the College variety and produced more grazing through the winter. The latter, however, more than compensated for this by the very heavy silage crop yielded and finished by producing over 2 tons more (green weight) than the Australian seed. The College variety is the latest maturing of the cereals tried and it was not enough advanced in growth for a first cut to be taken on 26th April.

Black Skinless Barley gave the heaviest first cut of all the plants on trial, but, after this, production lagged considerably. Even so, the amount of grazing was heavier than from any other series. The silage cut was very disappointing, and was only half that given by the College Algerians. This brought down the total yield to a very low figure, and, excluding Cape barley, was the lowest in the trials.

Cape Barley alone gave a poorer yield of grazing and rather a heavier silage crop than the black barley, and the total yield was the lowest in the trials. As has been mentioned previously, mildew attacked this crop to a minor degree, and the true reflection of this on yield is impossible to determine, but it is feasible to suppose that the total yield would have been at least as great as that of black barley. The yield at the first cut was intermediate between that of oats and black barley, and recovery and subsequent yield were no better than for black barley.

GRASS AND CLOVER SOWINGS.

Italian Rye-grass with and without Red Clover gave a very poor initial yield as compared with the cereals. Even on the second cut, eighty-five days after sowing, the yield was relatively poor, but the third cut (mid-July) was the heaviest got from any of the trial plots, while the fourth cut (23rd August) was only slightly exceeded by oats and oats and vetches. The red clover, though it germinated and showed above ground sixteen days after sowing, did not contribute substantially to the yield until the final (silage) cut, where red clover and rye-grass outyielded the pure rye-grass sowing. Owing to the relative slowness of growth, the silage crop would have been heavier had these plots

been cut somewhat later. The amount of grazing was disappointing, and was less than from any of the pure cereals, but the heavy silage crops placed them above the pure barleys for total yield.

Prairie-grass as a grazing crop in the first season was very unsatisfactory, and gave the lowest yield of grazing of any of the plots. It was comparatively slow in establishment and yielded poorly until the final cut (silage), when it was exceeded by oats and Italian rye-grass. This brought the total yield higher than the pure barleys, but not up to the level of any of the other plots.

Discussion.

It will be seen from what has already been written that by a study of stock-feed requirements it is possible to regulate the supply of winter-grazing crops accordingly. Where a grazing is desired from April to the end of May the barleys are outstanding, but their subsequent growth is so poor that to sow them alone does not seem desirable. If they are sown with 1 bushel of rye-grass a good silage crop can be assured, and, if required, a subsequent crop of hay can be got from the rye-grass. The weakness of this combination lies in the period between the end of May and the end of August, when production is low. The rye-grass is suppressed strongly by the heavy initial yield of the cereal and only recovers as the barleys fail. This suppression of the rye-grass is less evident with Cape barley than with black skinless, but it is relatively less palatable. No other plant tried can approach the barleys for early growth. For production later in the season both oats and rye-grass are outstanding, and a combination of the two gives the prospect of a very heavy silage crop and a further hay crop if so desired. This combination of a cereal with rye-grass from a yield point of view, and where grazing is an important feature, is better than oats and vetches or oats alone, and better than rye-grass alone or with red clover. Prairie-grass is out of the question for a single season's production, as, although the yield in spring is good, it is too slow in establishment for a winter-grazing crop. Rye-corn did very indifferently in the trials in both years, and cannot be recommended for this purpose.

The disadvantages of the pure sowings briefly are: (1) Danger from disease in the cereals, which lowers their production and palatability; (2) the extreme tuftiness and lack of foliage in the black barley after the first two grazings, which makes it unsuited for ensiling; (3) the lower palatability of Cape barley; (4) the relatively poor early growth of oats; (5) silage made from cereals is not suitable for keeping longer than one season when stacked owing to the rapidity of deterioration; (6) Italian rye-grass, like oats, is too slow in its development to warrant being sown alone; (7) it is poor economy to grow for winter feed a crop which requires to be reploughed and reseeded in spring before the silage crop is taken (as with barley) or if the silage is taken (oats) where there is risk of the failure of the succeeding crop due to lack of soil-moisture.

The sequel to an even production throughout the winter would be to divide the area for winter forage crops into two. In one-half sow black barley with rye-grass and in the other oats and rye-grass. The areas need not be fenced separately, for, although the oats will attract

the stock first and they will be grazed closer to the ground than the barley, yet the growth habit is such that little damage is done to them. The gradual increase in the amount of rye-grass appearing in the barley will continue to attract the stock to that area and the barley will be grazed with it. The oats are at all times palatable and eagerly grazed, but the barley will not be neglected.

The effect of the incidence of disease in either the oats or barley will be less felt where rye-grass is present. If disease appears on the cereal, the decreased competition from the infected plants enables the rye-grass to increase its production earlier as a compensation. In view of this danger of disease appearing in the cereal, rye-grass should always have a place in such a winter programme. Also the very early spring feed it provides is extremely important in dairying. It is more palatable to stock than permanent pasture, and it helps to avoid excessive defoliation of the best fields at a time when the cows are in full milk and when the pastures are very sensitive to hard or close grazing. Similarly, it reduces the necessity of cutting the permanent grass paddocks too frequently for hay or silage, and thus helps towards a greater production over the whole farm and a better return from the stock. I suggest that the combination of these factors alone warrants and covers the cost of ploughing up and reseeding to permanent pasture. It is impossible to assess the cash value of such a crop as its benefits are not confined solely to its immediate returns, but are distributed over the farm.

The heavy seeding of cereals as described here may appear excessive on some farms though not on others. In seasons when cereals are cheap heavy seedings are likely to be more profitable than lighter sowings, but where rye-grass is sown conjointly with a cereal, heavy seedings should be avoided, as any increase in yield from the cereal is discounted by a slower recovery of the rye-grass. Thus the earlier the cereal in producing its maximum yield, the greater the danger to the rye-grass through too heavy seeding.

It is desirable, in order both to conserve the amount of feed in winter and to prevent digestive trouble in the cattle, to limit the grazing period to one not exceeding two hours per day.

With the improvement of Italian rye-grass now being undertaken it would appear that the benefit to be derived from the inclusion of this grass in the cereal sowing will be considerably greater in the future.

It is highly probable that sowings at dates substantially different from those followed in the trials under discussion would modify the results materially.

Control of Cattle-tick.—During recent years the whole aspect of the cattle-tick question in New Zealand has more or less undergone a change, a realization that the tick is not a dangerous stock parasite having taken the place of the dread at first created by the discovery. In the control of cattle-tick much can be accomplished by individual effort. Farmers in tick-infested areas could largely prevent tick propagation by the burning or destruction of all cover which gives the immature ticks protection during the winter months. This, combined with other protective measures, would materially tend to keep their numbers on any one farm very low. With respect to this point the District Superintendent, Auckland, makes the following remarks: "I am quite sure that ticks can be controlled to a great extent if property-owners will spray their cattle a few times during the worst season of the year, hand pick at other times, and also clean up and, if possible, burn rubbish in odd parts of the farm."—*Report, Director, Live-stock Division.*

ELECTRIC TRACTORS.

FIELD EXPERIENCE IN CANTERBURY.

E. M. BATES, Instructor in Agriculture, Ashburton.

THE prospects of a closer coupling-up of New Zealand's great electrical resources to our agricultural industry, by the greater use of power, appear very bright now that the possibilities of the electric tractors have been clearly demonstrated on a number of Mid-Canterbury farms by the cultivation work carried out by locally made electric tractors. It is clear not only that these tractors are dependable, but that they are characterized by cheapness and ease of operation.

FIG. 1. CLOSE-UP VIEW OF ELECTRIC TRACTOR, SHOWING THE CRANE TAKING UP THE CABLE.

The winding-gear is quite automatic.

Though the cost of power is a very heavy item on most of the arable lands of Canterbury, yet probably it has received the least attention from research workers. Power on the farm to-day is supplied principally by horses, but internal-combustion tractors also play an important part, there being about 1,800 in Canterbury.

From the national aspect the utilization of electric power for cultivation work is most desirable. The absorption of our surplus electrical power by the agriculturist, the manufacture of electric tractors, and the reticulation of farms would result in further employment without any displacement of labour due to any change-over, and, further, a more general use of electrical power would probably result in a general lowering of power charges.

That we are now in a position to utilize the power generated from our abundant water-supplies in the tilling of our fields with a reduced financial drain on the country is an inspiring thought.

General Description of Electric Tractor.

The first electric tractor was built on a 12/24 horse-power Hart-Parr chassis with a 20 horse-power three-phase motor in place of the kerosene power-unit, with 20 chains of flexible C.T.S. cable on a drum with automatic winding-control gear. An ammeter to indicate loading and a watt-hour meter are in the supply-line. The cable is automatically laid and rewound as the tractor moves to and fro in any desired direction from the plug-in point, and it is impossible to run over the cable, which causes no trouble or inconvenience to the operator. This tractor has now been in operation for two years and its operation is

FIG. 2. THE ELECTRIC TRACTOR CULTIVATING AND ROLLING IN ONE OPERATION
The cable is being laid behind the implements and easily clears these.

delightfully simple and easy, besides being quite fool-proof and free from complications of any kind, and the use of a transformer-truck, which is part of the outfit, makes the tractor quite mobile.

The difficulty of moving the end of the power cable from one plug-in point to another has been overcome by the use of the transformer-truck. This consists of an old truck or converted car fitted with two gear-boxes giving a wide range of gearing and carrying a transformer with a convenient connection to the power-lines. Contact with the power at a different place can be made in a few minutes with the truck in a very simple, safe, and ingenious method by driving the truck to the required pole, pulling a lever, and making a ground connection. The truck can also be used for bringing up implements and for long cartages of the tractor if required.

The electric tractor has the following advantages: (1) Economy of operation—about half that of the kerosene tractor and comparable and competitive with the crude-oil tractors; (2) quickness and ease of starting, with smooth and quiet running on the drawbar or belt;

(3) freedom from fumes and noise; (4) plenty of overload capacity when necessary; (5) no danger of excessive power-unit wear in operating at full load; (6) accurate costs of working available at all times; (7) immediate means of judging efficiency of setting ploughs, &c.; (8) low operating-costs at low capital outlay; (9) no cartage of fuel, no refuelling, changing of lubricating-oil, or draining and filling with water.

A disadvantage of the tractor is its unsuitability to work round a field—a matter of small moment, except in case of, say, reaping a standing crop. Methods whereby the tractor and also the transformer-truck could be used are under consideration and will be tried out on

FIG. 3. SIMILAR TO FIG. 2, EXCEPT THAT CABLE IS BEING WOUND IN.

standing crops this season. On a number of farms headers are now being used, but the autoheader is the only one not requiring to be drawn by horses or tractor.

General Costs of Farm Power.

There has been a tendency since the beginning of the depression to revert to horses for farm-power. There are now indications that the tractor is again coming into favour. The principal reason for the favouring of horses was said to be cheapness of operating, but investigations show that the underlying reason was the reduction of the cash outgoings from the farm possible with horses as against tractors—the gross cost was not seriously considered. Putting the cost of a six-horse team at £300 per annum and the working-time 250 days of eight hours, the cost per hour is 3s. A medium-sized tractor has about 50 per cent. more, and a large tractor 100 per cent. more output than a team and can also be worked long hours at rush periods. The total operating-costs of a kerosene tractor is about 5s. to 6s. per hour, and is therefore competitive with horses. The increasing capital cost of horses is also a factor in encouraging a swing back to tractors. The

fact that the electric tractor does not entail a high capital outlay, is cheap to run, has a long life, and can be worked for longer hours than a kerosene tractor, when consideration is given to the loss of time refuelling, changing of engine-oil, and starting, are all points in its favour as far as costs are concerned.

Some Results of Operating-costs with Electric Tractors.

An electric tractor provides a direct method of ascertaining relative costs for the various cultivation operations, for testing the relative efficiency of implements with greater accuracy than any other means by the direct measurement of current used. Horses and kerosene

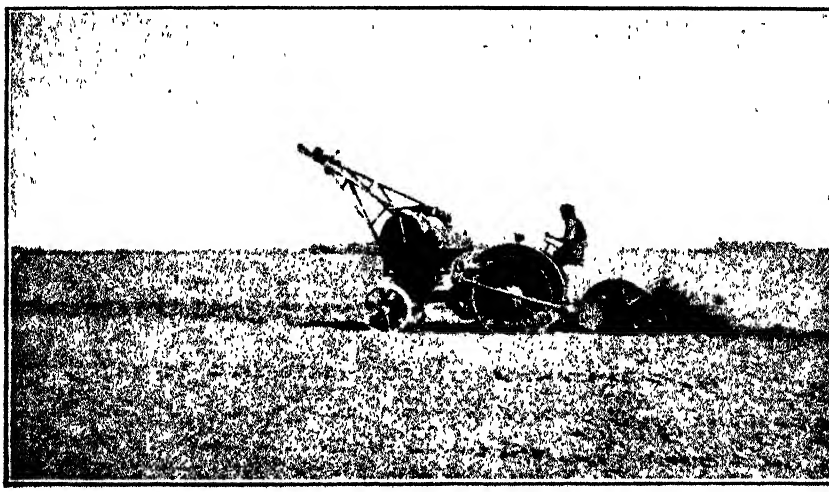


FIG. 4. THE ELECTRIC TRACTOR PULLING ROTARY HOE

Cable is being wound in automatically. Note the power drive to the hoe.

tractors can only be approximate, and the latter usually are under-loaded in fear of consequences of overloading.

The following is a brief summary of some of the work carried out to date, using mainly the first experimental tractor with a 20-horse-power motor.

(1) *Ploughs.*

The draught of the first plough used—a four-furrow American plough—was reduced by measurement of current used in different setting by 6 horse-power. Ploughing has only been carried out on heavy land to date. Ploughing out of stubble 7 in. deep in June with a four-furrow American plough in middle gear at three miles and a quarter per hour used 19 units per acre, which at 1d. per unit cost 1s. 7d. an acre. In low gear at two miles and a half per hour took 18 units per acre, or 1s. 6d. an acre for power. A New Zealand plough in low gear took 24 units per acre.

At Springfield in skim ploughing 2½ in. deep on heavy clay soil out of four-year-old grass, mainly twitch, and used as a horse paddock,

a New Zealand plough showed 25 per cent. increase in power requirements over an American plough and made a poorer job on the hardest portions on account of riding out of the ground. The short mouldboard of the American plough did not give the hard packing of the New Zealand plough, more especially with the deep ploughing, and while it did not make such a pretty job, the more broken furrow appears preferable quite apart from the lighter draught. Results as the above raise a doubt as to the suitability of the design of New Zealand ploughs, and, while not necessarily conclusive, indicate the advisability, in the interests of cheaper cultivation costs, of a study of the whole question.

(2) *Top-working Implements.*

An eleven-tine spring grubber on skim-ploughed twitchy paddock in middle gear used 7½ units per acre. After harrowing with tripods it used 7 units per acre. A second grubbing in top gear used 6¼ units per acre. Contrary to farmers' opinion, the grubber was not a full load for the tractor. A third grubbing with also a set of twitch harrows behind used 9 units per acre. Tine harrows with a set of tripods in front used 10¾ units against 7 units with tripods alone. With the accumulation of data of this sort, implements could be made of sufficient width for most economic loading, or the work conducted by using implements in pairs. The ammeter indicates directly what the loading actually is.

Tests such as the above are ones that any farmer could easily make for himself, and there is no doubt that work with a high degree of precision and of very great value to the farming community could be compiled. Tests on the electric tractor indicate that at full load approximately 40 per cent. of input is taken up by the tractor, hence for economic operation "the paying load" must be kept up.

Tobacco-culture.—There has been a reduction in the area planted in tobacco for commercial purposes during the year ended March, 1934. This was largely due to the fact that the manufacturing companies operating in the Motueka district, where the bulk of the crop is grown, intimated to growers at the beginning of the season that only the amount of leaf contracted for would be purchased, thereby placing a limit on the area planted. The total area under tobacco in the Dominion was approximately 2,500 acres, the bulk of which—some 2,000 acres—being cultivated in the Motueka district. In the other tobacco-producing districts the acreage was: Auckland, 334 acres; Nelson, 60 acres; and Marlborough, 16 acres. A considerable quantity of tobacco was also grown in garden plots for private use.—*Report of Director, Horticulture Division.*

Mycotic Dermatitis.—This inflammatory condition of the sheep's skin has been found affecting flocks in different districts. Several cases of its occurrence have been noted in Canterbury. It is an inflammatory condition of the skin, with resulting scabs, which grow up in the wool, forming dense, hard masses, which render shearing difficult or impossible. The disease is caused by a mould or fungus and is contagious. The disease is common in Australia, where it is said to occasion considerable economic loss. Moist conditions favour its development, and it is more common in districts with heavy rainfall. There is no known treatment for the trouble, and separation of affected from healthy sheep is essential to prevent spread. Sheep-farmers would be well-advised to report any suspicious cases to the Department for investigation.—*Report of Director, Live-stock Division.*

SOME OBSERVATIONS ON THE IMPORTANCE OF SUBTERRANEAN CLOVER AS A PASTURE SPECIES.

W. J. McCulloch, Fields Superintendent, Palmerston North.

Within recent years much attention has been focused on the more important pasture species, the majority of which are particularly adapted for high production on the better-class soils with a reasonably heavy uniform rainfall. Unfortunately there are large areas, usually lighter and drier, in this Dominion not fitted to carry these high-class pasture species profitably, and some observations relative to the value of subterranean clover on these lighter and drier soils may prove of interest.

One has in mind, particularly, areas of light country in the eastern districts of both Islands where pasture growth practically ceases in the late summer months owing to lack of moisture and where the soil fertility cannot be raised economically to the standard demanded by high-class pasture species

Subterranean clover has for many years been recognized in New Zealand (sometimes as Mangere clover, especially in Auckland) as a somewhat useful species on the light, poor country which normally dries out badly in the summer months and on which conditions would be too severe for white clover or the better grasses. Subterranean clover is a free seeder capable of re-establishment annually, and under such conditions its introduction on these soil types has been looked upon as a useful development in that the feed it provides is a much preferable alternative to practically no feed at all, such as often obtains at present. While in the main such a viewpoint cannot be condemned, it falls far short of present-day knowledge of the importance of subterranean clover on the poorer dry soils under good management. It may be stated definitely from results obtained that subterranean clover can be very profitably exploited on these particular areas, as is indicated by the experience of Mr. J. Caldwell, Spring Hill, Ruatanawha Plains, Hawke's Bay.

An area of 600 acres of very light country was taken over by Mr. Caldwell in 1914. The normal annual rainfall is very low and the light-textured soil is incapable of retaining moisture satisfactorily, and in consequence ordinary grasses and clovers cannot withstand the hard conditions. In its natural state it supported manuka scrub, and in the words of Mr. Caldwell "grew Strathmore weed to perfection."

To give some indication of the class of soil Mr. Caldwell recalls that the first paddock broken up in 1914 (fig. 1) was badly blown, after which only the two top wires of the seven-wired fence on one side of the field was visible. This paddock was eventually sown down in 1918 with a mixture of rye-grass, cocksfoot, Chewings fescue, and white clover, but rapidly reverted to manuka and Strathmore weed. In 1928 it was cleared of scrub, cultivated, and subsequently sown out in a stand of pure subterranean clover at 10 lb. per acre with the result indicated by fig. 1.

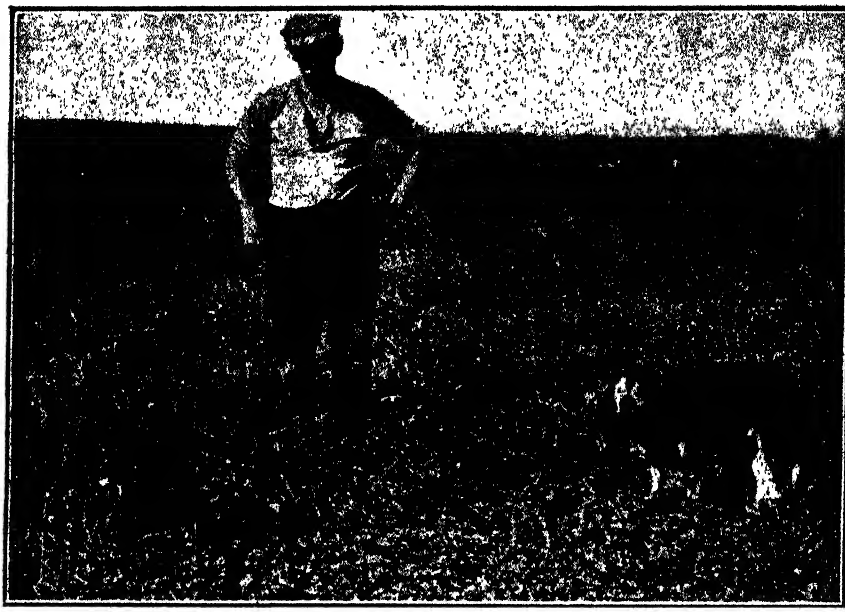


FIG. 1.

This paddock carried, from 1st August to 28th November, when photograph was taken, 8 cows and 3 horses, in addition to 140 ewes with 100 per cent lambs, which were carried from 1st August to 2nd November, when lambs were drafted fat, as part of a line of 475 lambs which averaged 36·85 lb. Area of paddock, 35 acres.

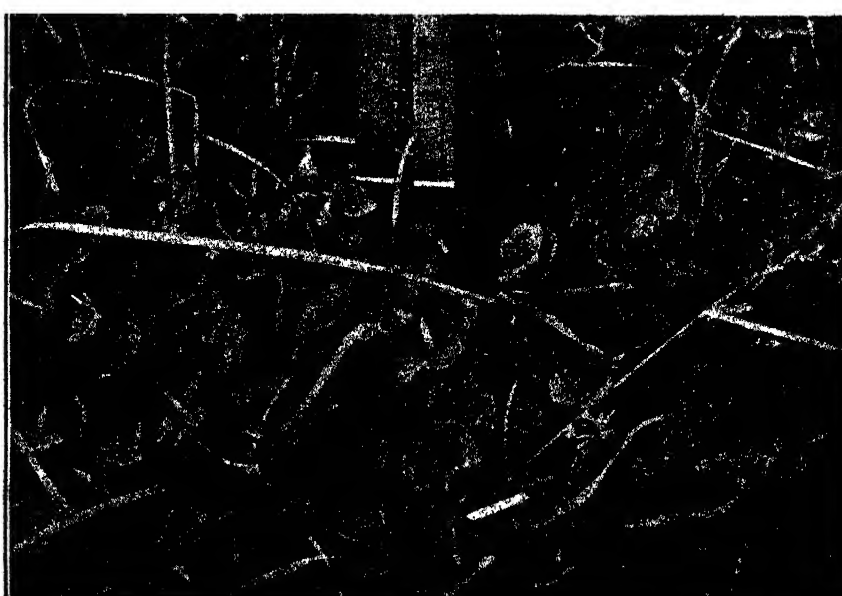


FIG. 2. CLOSE-UP VIEW OF PADDOCK SHOWN IN FIG. 1.

From 1914 until eight years ago the total stocking of the 600 acres never exceeded 400 breeding-ewes, and no fat lambs off their mothers were produced. A team of horses was kept busy in an attempt to grow rape for lamb-fattening, which more often failed owing to dry conditions, in which case the lambs had to be sold as stores. The production of winter feed for ewes also caused much anxiety for the same reason. The lambing was usually about 50 per cent., and one instance is mentioned by Mr. Caldwell when a total of only forty lambs were raised for the season.

No doubt only sheer tenacity, together with high market values for sheep products, made it possible for the owner to carry on during those difficult years. For the past seven to eight years, solely with the aid of subterranean clover properly managed, the stocking has steadily increased until the 600 acres now carries 1,200 breeding-ewes, which produced 110 per cent. lambs last year and 100 per cent. during the present season, and all go off the ewes fat.

During the past few years, since the advantages of subterranean clover have been fully realized, no crop is now grown either for fattening lambs or ewes or for wintering stock.

This season, out of a total of 1,200 lambs, 475 fat lambs were drafted on the 2nd November and killed at an average of 36·85 lb. per lamb. As a rule the ewes are fat at weaning and quickly follow each draft of lambs to the works.

It is hoped to dispose of all lambs and ewes as fat towards the end of December

This type of management suits the habit of subterranean clover admirably, as by the end of December it completes its growth and matures seed ready for the first autumn rains.

A pure subterranean-clover pasture has certain distinct weaknesses, prominent among which is its failure to produce growth from about the latter end of December until, usually some time in March, the seed germinates with autumn rains. It is probable that this weakness could be overcome by the establishment of paspalum or cocksfoot, according to climate, in conjunction with subterranean clover, or the saving of sufficient of the surplus growth in spring as silage, especially as the period mentioned is merely a store stock one and only a matter of maintaining ewes intended to be held over for breeding purposes. If it is lightly stocked to allow the young seedlings to become firmly established they rapidly increase in vigour and eventually provide an abundance of late autumn, winter, and spring feed until the middle or end of December, when the clover begins to die off, having meantime produced seed heads the majority of which have buried themselves in the soil where they mature. Although fairly proof against grazing abuse, this plant responds admirably to reasonable care in the young-seedling stage and again when the seed heads are forming, during both of which periods it should not be grazed closely but rather a form of loose management involving the development of growth longer than is generally accepted as most suitable for sheep should be adopted.

Probably the most important factor of all in the establishment and maintenance of a luxuriant and profitable subterranean-clover pasture is the systematic top-dressing of the sward. No other plant responds more profitably to phosphatic manuring than subterranean clover, and

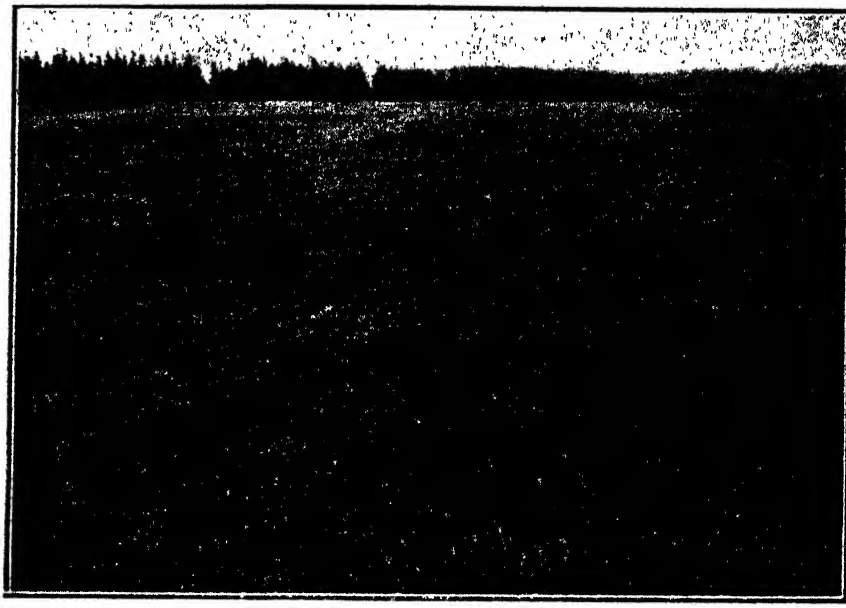


FIG. 3.

Paddock of 30 acres which carried 90 ewes, with their lambs, from the last week in July till 1st September, when 50 more ewes, with their lambs, were added. Both these lots of sheep were carried from 1st September to 26th November, except that 70 lambs were drafted fat on 2nd November.

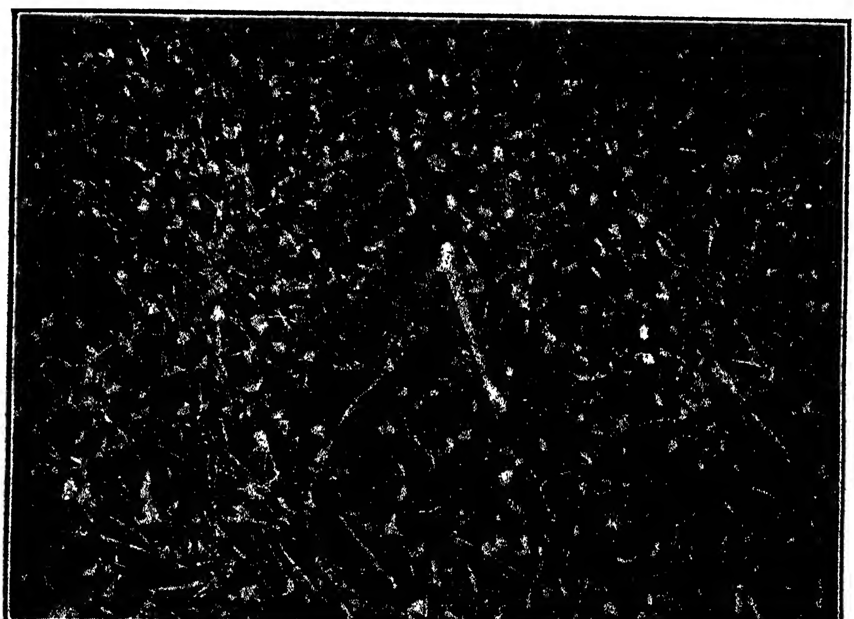


FIG. 4. CLOSE-UP VIEW OF PADDOCK SHOWN IN FIG. 3.

in every instance the greatest success has been obtained from an application of from 2½ cwt. to 3 cwt. of superphosphate with the initial seeding, and subsequent similar applications annually about March. The seed should be sown as early in March as possible provided sufficient rain has fallen, the chief object being to encourage the young plants to obtain a good root-hold before heavy frosts occur. Late sowing should always be avoided.

Liming is unnecessary, as subterranean clover is well known to be more tolerant of soil acidity than any others of the clover family.

It is suggested that subterranean clover should be sown as part of a mixture rather than as a pure stand provided local conditions permit of some growth from other species. However, if conditions are too severe, then a pure stand of subterranean clover may be preferred, firstly because of its very profitable production, and secondly because of its great value as a soil-improver and a forerunner to rye-grass, cocksfoot, white clover, &c., in later years. A noticeable feature on Mr. Caldwell's pastures this season is the development of volunteer rye-grass, cocksfoot, and white clover, which indicates a general soil improvement. It is evident that the dying-down of considerable quantities of surplus subterranean clover growth each season is already responsible for an appreciable amount of added humus, which in turn has increased the moisture-holding capacity of these thin soils as well as their fertility.

The proportion of subterranean clover in a mixture may be varied in accordance with the rapidity with which dominance of this species is desired, and from 2½ lb. per acre, together with rye-grass, cocksfoot, white clover, &c., up to 8 lb. or 10 lb. where a pure stand is required, may be sown.

It is probable that where conditions are too dry or fertility is not sufficient a combination of cocksfoot and subterranean clover would best meet requirements, or, if too hot and dry for the former, it might be replaced by paspalum.

The above experience illustrates the value of subterranean clover on poor, light, dry soils, but there is evidence that subterranean clover is capable of raising the production of many thousands of acres of the poorer soils, and even on our better soil types its prolific growth in the winter and early spring months when other pasture species are practically at a standstill may justify its inclusion in such mixtures.

Mr. R. H. Matthews, owner of the well-known Wairongomai Romney stud flock, is emphatic from his experience that subterranean clover will not "take possession" on good soils to the detriment of other good pasture species, and he, in common with others, finds that on areas where subterranean clover is established it provides excellent feed with swede crops in which it appears during autumn.

Young stud rams commence feeding off swedes about the 20th April, and are not given a run-off as they thrive particularly well on a ration of swedes and subterranean clover.

Mr. Matthews is positive that since 1924, when subterranean clover was first sown, the ram hoggets have shown marked improvement.

On certain shingly paddocks of this property subterranean clover forms a dense sole and produces handsomely. That it is a very adaptable plant will be recognized, as the rainfall at Wairongomai is in the vicinity of 50 in. per annum.

Well-established subterranean clover produces heavy yields of seed, which apparently remains viable in the soil over a fairly lengthy period should the land be put under crop. This is evidenced in the case of Mr. W. H. Sadler, Tauherenikau, who is dairying on 130 acres, most of which is light, dry, and stony. Subterranean clover was introduced here over twenty years ago, and has since established itself over the whole farm. It does not appear to any extent in spring-sown crops which are fed off early, but always asserts itself in autumn-sown pastures in sufficient quantity without being added to the mixture, and here also it is highly valued for its prolific winter and early spring growth and for the definite soil improvement which has taken place, making it now possible to maintain an appreciable definite proportion of rye-grass, cocksfoot, and white clover on land which originally carried only danthonia and sweet vernal. Here also phosphatic top-dressing is applied annually.

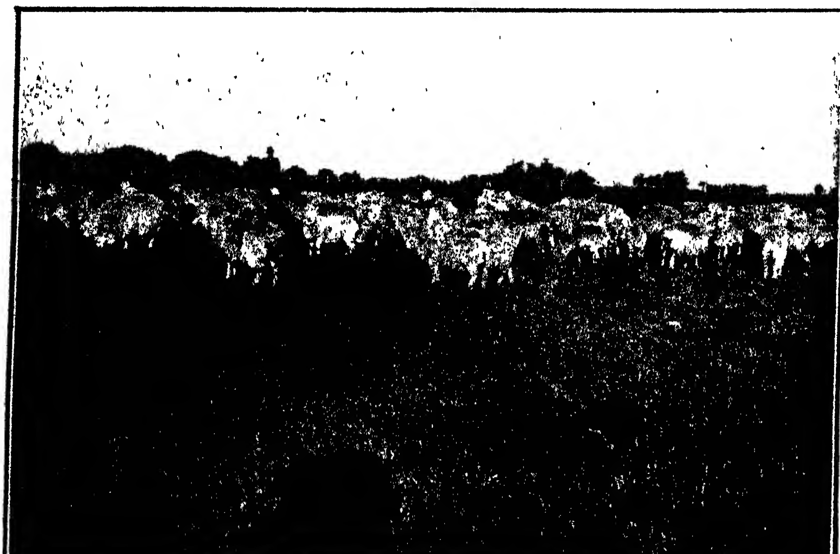


FIG. 5. EWES, WITH LAMBS, CARRIED IN PADDOCK SHOWN IN FIG. 3 AS AT 28TH NOVEMBER.

Up to the present the seed is imported from Australia—none being grown in New Zealand. There appears to be no valid reason why this should be so; on the contrary there appears to be two very good reasons why New Zealand should produce its own seed requirements, namely: (1) The New Zealand farmer should be able to produce the most suitable strain profitably; and (2) the grave danger of introducing lucerne flea (*Smynthurus viridis*) with imported subterranean clover seed, which would be fatal not only to subterranean clover, but also to our own lucerne areas.

In conclusion, it is suggested that subterranean clover can play a very important part in increasing the production of the lighter, dry soils of this Dominion, and, as such, well merits further investigation in regard to strain and closer attention to management, &c.

PROTECTION OF PEAR-GRAFTS FROM THE PEAR-LEAF-CURLING MIDGE.

N. J. ADAMSON, Orchard Instructor, Hastings.

ALTHOUGH in some pear-growing districts the pear-leaf-curling midge (*Perrisia pyri* Bche.) is not a serious pest on mature trees, it is of considerable economic importance on young trees, and more particularly on new grafts. Recently there has been a good deal of activity amongst

pear-growers in reworking unprofitable varieties to the better-known and exportable sorts, and in many instances results have been very disappointing, due to the ravages of the midge. It is of vital importance in reworking fruit-trees that scions receive no injury which may weaken or destroy them. The midge is capable of actually destroying the scion, so that it becomes a matter of importance to afford some protection in districts where the pest is prevalent. Attempts have been made at times to protect new growth from scions by a light covering of muslin. The type of protection used by Mr. A. B. Clayton, of Havelock North, Hawke's Bay, as is here illustrated, afforded a complete protection to scions against the midge and allowed them to grow normally. The frames are constructed by fixing No. 14-gauge wire rings to light battens, which are nailed to the tree-stumps. Bags made from cheese-cloths are then drawn over the wire frame and tied at the bottom. A simple method of fixing the wire rings is by pressing the tie-in-the-wire into the soft-wood battens, using a vice for the purpose. The tie should be made in such a way as to leave ½ in. wire ends directed inwards, thus acting as a staple. Coverings may be left on until about mid-November, by which time the scions will have become well established and the midge attack subsided.

The photograph shows, on the left, the simple frame construction around a previously protected scion, which has grown without injury from midge ; on the right, a covered scion ; and in the centre one that has remained unprotected and that shows distinctly the injury which results from midge attack, and thus demonstrates the advantage of covering.

LIVE-STOCK POISONING IN NEW ZEALAND.

PROCEDURE IN COLLECTING SAMPLES FOR ANALYSIS.

B. C. Aston, Chief Chemist, Department of Agriculture.

(Continued.)*

In investigating any unusual mortality in domestic animals on the farm it may be necessary to obtain specimens for the analyst in order that he may examine them for the presence of poisonous plants or minerals. The farmer or other person who may be called upon to supply specimens from the dead animals is therefore required to obtain sufficient material for analysis, and if this work of sampling is not properly carried out the whole subsequent costly work of the analyst may be rendered useless. It is desirable to point out the correct method of obtaining samples in order that those responsible for this work may in future avoid the errors which have occurred in the past.

In order that the analyst may be able to say with certainty whether poison is present in the dead body in sufficient quantity to have caused death he must be supplied with sufficient material to enable him to extract the poison, identify and weigh it, and thereafter to calculate whether sufficient poison is present in the whole body to have destroyed life. The main fault to be found in the past has been that too little material has been forwarded to enable any decision to be reached by means of chemical analysis as to the cause of death. The larger the animal the more material must be taken, and where leaves of poisonous shrubs are to be sought it is in the highest degree necessary that a plentiful supply of the paunch contents be sent. If, as recently happened,

* First portion in this *Journal*, September, 1934.

no material from the paunch is sent and it is desired to identify tutu leaves in the mixture of food eaten it is hopeless to try to do this from the semi-digested mass in the fourth stomach and intestines.

The commonest kind of poisoning is undoubtedly that caused by substances classified as inorganic or mineral poisons, and it is in this case highly necessary to take samples of the liver and spleen as well as a copious supply of ingesta for the analyst as well as possibly other specimens for the use of the pathologist. Those for chemical analysis should be placed in clean containers, which are best obtained in advance as there is often difficulty in obtaining suitable containers on the farm at the last moment. The samples for chemical analysis should be sent as soon as possible to the Department's Laboratory in the Dominion Laboratory Building, Wellington, since it is not permissible to add any preservative or alcohol to the specimens to prevent putrefaction, and any delay in delivery is likely to hamper the work of the analyst owing to decomposition of the material, and even to militate against a successful result.

The appended directions should therefore be implicitly followed in collecting specimens for chemical analysis where poisoning is suspected.

(1) No metal, soil, or other contaminating substance should be allowed to come into contact with the animal specimens. Wide-mouthed, chemically clean glass or earthenware jars, fitted with earthenware covers or new cork bungs (not metal caps) should be used. Stomach and intestine contents should be allowed to remain in the natural organ, the apertures of which should be tied with string to prevent leakage.

(2) If possible, where concentrated food is used a sample of the last food that the animal fed on should accompany the other specimens.

(3) Nothing whatever should be added to the specimens, and this injunction applies to water as well as preservatives of all kinds. Samples should be forwarded direct to the Laboratory by the quickest method, and, if necessary, the containers may be packed in ice or otherwise transported in cold storage during hot weather.

(4) In the case of small animals such as bees and birds, a quantity or number of entire carcasses should be sent. In large animals the material forwarded should include the whole or a considerable portion of the stomach and its contents, or in the case of small ruminants (sheep, goats, &c.), of the rumen (paunch), omasum, abomasum, and their contents packed separately and labelled, together with the entire liver and spleen. In the case of large ruminants (cattle beasts, deer, &c.) portions only of ingesta and liver may be sent.

The person taking samples should try to visualize the difficulties of the analyst where five or six portions of the ingesta may have to be used by different methods applied in searching for different poisons. Hence small quantities such as a cupful of ingesta are insufficient to ensure a positive result being obtained. Analysis of animal organs for poison is one of the most expensive investigations the chemist has to perform, as it involves detailing a highly salaried officer for this work alone, and the use of much alcohol and other highly priced chemicals in the operations involved. All care should therefore be taken to supply the analyst with adequate samples in order that failure to obtain a positive result may not bring blame on those taking the samples. Farmers, if possible, should always consult the local officer of the Live-stock Division available, whether he be Veterinarian or Stock Inspector,

before sending in any samples of the above nature. The Government analysts undertake the duty of analysing animal specimens only when it is distinctly in the public interest that such work should be undertaken, and the person who can best interpret what is in the public interest is the local officer of the Department. The expense of carrying out an investigation of this nature on a dead animal is not lightly to be incurred, as it may easily amount to more than the animal is worth, say, five to fifteen guineas, the analyst having to spend perhaps the best part of a week in the work.

In many cases it may be desirable to take specimens with a view to the elimination of poisoning as a cause of death, the idea being to establish the presumption of the occurrence of some rapidly occurring disease such as anthrax or swine-fever, in which case the samples must be as carefully taken as if it was suspected that an ordinary poison was the cause of death

REVIEW.

Manual of the Rusts in United States and Canada, by J C. ARTHUR, Sc.D., LL.D., Octavo, xv + 438 pp. One map and 487 text figures. Purdue Research Foundation, Lafayette, Indiana, U.S.A.

THE publication of this book climaxes a life-study of the rust fungi by the author, long recognized as the leading authority on this Order. Always progressive—and at times revolutionary--in outlook, Dr Arthur has been responsible for stimulating to an unusual degree an interest in these complex organisms. The appearance of this work has therefore been anticipated with a much greater degree of enthusiasm than is usual for a scientific treatise. Perusal shows that this interest is justified, for the presentation departs markedly from that customary in taxonomic publications. The "Manual" covers all rust fungi known to occur in the United States, Alaska, Aleutian Islands, Canada, Newfoundland, and Greenland. Descriptions are given of some 737 species and form-species, and 67 varieties, which are placed in 32 genera and 5 form-genera grouped under the families *Melampsoraceae* and *Pucciniaceae*. These are masterpieces of condensation, the taxonomic details necessary for identification being covered in a few lines. Accompanying the descriptions are details of host range, relevant synonymy, cultures (where undertaken), and distribution. Workable keys are given as aids to identification of the genera and species. The taxonomic part of the book is prefaced by tables of abbreviations, a list of specialists who have studied the rust fungi, and a half-page glossary; and followed by admirable host and fungous indices. A feature of the work is the 487 line drawings (executed by G. B. Cummins) illustrating the taxonomic details of the spores. The "life-cycle" classification used by the author in *North American Flora*, Vol. 7, has been replaced by a morphological arrangement. As a result the taxonomic treatment of the order has been simplified, many well-known generic names reinstated, and dozens erected under the former treatment consigned to synonymic oblivion.

Our criticisms of the book are threefold: First, the International Rules of Botanical Nomenclature have not been followed, with the result that many invalid names are used. Secondly, the terminology employed necessitates an Arthurian glossary. Such, unfortunately, has not been supplied in the "Manual"; consequently many parts are unintelligible unless read in conjunction with a previous publication ("Plant Rusts") issued in 1929 by Dr. Arthur and his colleagues. Thirdly, confusion must follow his grouping of *Uromyces* under *Puccinia*. Both are undoubtedly correlated, but are as distinct morphological entities, nevertheless, as any two rust genera, and certainly more so than many—*e.g.*, *Physopella, Cumminsiella, Nyssopsora,* &c.—erected by Dr. Arthur. We fear that by European workers this treatment will be regarded as "distinctly American" and suffer in consequence the same fate as the now defunct "life-cycle" classification.—G. H. C.

WHEAT VARIETIES, HARVEST OF 1934.

THE figures appearing in the following table were compiled from monthly returns furnished by proprietors of threshing-machines up to the end of August, 1934. The total area accounted for in this manner was 256,069 acres, out of a total area of 286,271 acres of wheat threshed, according to the annual collection of agricultural and pastoral statistics carried out by the police on behalf of the Census and Statistics Office.

Of the three classes in which wheat varieties are grouped, Tuscan easily occupies first place with 74·96 per cent. of the total area threshed. The Hunters group follows with 17·08 per cent of the area threshed, while Pearl accounts for the balance of 7·96 per cent. of the total area.

In the Tuscan group the variety Red Marvel shows up very poorly for average yield compared with other varieties in that group The figures do not, however, give a true indication of the merits or demerits of this variety, as the bulk of it was grown in Nelson Land District. It will be remembered that a severe and prolonged drought was experienced last season in the Nelson and Marlborough districts, and crops suffered accordingly.

The same explanation applies in the cases of Major and Federation wheat respectively shown in the Hunters group The greater portion of the former was located in Nelson Land District, while the latter was confined principally to Marlborough Land District. Under normal circumstances, larger yields would doubtless have been realized

Variety of Wheat threshed.	Area threshed.	Total Yield	Average Yield per Acre	Per Cent. of Total Area.	Percentage of Total Yield.
Tuscan—	Acres	Bushels	Bushels		
Solid-straw Tuscan	180,034	5,837,771	32·43	70·31	68·28
Dreadnought	5,812	239,054	41·13	2·27	2·80
Montana King	1,677	54,830	32·71	0·65	0·64
Hollow straw Tuscan ..	1,340	46,948	35·02	0·52	0·55
Velvet Ear	1,344	35,202	26·19	0·53	0·41
Sensation	714	26,612	37·27	0·28	0·31
Victor	327	14,213	43·46	0·13	0·17
Red Marvel	257	5,118	19·05	0·10	0·06
Other Tuscan varieties ..	443	13,942	31·47	0·17	0·16
Totals	191,948	6,273,690	32·68	74·96	73·38
Hunters—					
Hunters and College Hunters	30,252	1,163,894	38·47	11·81	13·61
Red Chaff	7,414	266,827	35·99	2·90	3·12
Bell's Hunters	1,844	80,983	43·93	0·72	0·94
Major	1,820	49,464	27·18	0·71	0·58
Federation	1,514	42,910	28·33	0·59	0·50
Yeoman	741	27,943	37·71	0·29	0·33
Other Hunters varieties ..	145	6,462	44·41	0·06	0·08
Totals	43,730	1,638,483	37·47	17·08	19·16
Pearl—					
Jumbuck	13,367	420,020	31·42	5·22	4·91
Velvet	3,129	106,353	33·99	1·22	1·24
Garnet	1,637	49,695	30·35	0·64	0·58
Marquis	1,475	35,372	23·98	0·58	0·41
Pearl	781	26,316	33·70	0·30	0·31
Other Pearl varieties ..	2	88	44·00	0·00	0·01
Totals	20,391	637,844	31·28	7·96	7·46
Totals, all varieties	256,069	8,550,017	33·39	100·00	100·00

—*Census and Statistics Office.*

SEASONAL NOTES.

THE FARM.

Some Phases of Summer Pasture Management.

ONE of the most important conceptions bearing on the summer handling of pastures utilized for the heavy or rapid production of meat or milk is that waving fields of grass are indicative almost invariably of a weakness in the grazing management—such fields are associated as a rule with the steminess that marks the passage of the pasture from yielding the "concentrate" class of feed to yielding the less-valuable "roughage" class of feed. The change in type of yield is of basic importance, because the roughage is likely to fall below the needs of the stock in respect both to its digestibility and its content of nutriment. This explains the somewhat paradoxical position that at times arises—firstly, when dairy stock which are "up to their knees in feed" fall off in yield at an unnaturally rapid rate, and again when fattening lambs are hampered not by the shortage but by the over-abundance of growth—of a sort quite unsuited to their needs when finishing off.

Another associated conception relates to the seasonal distribution of production. Briefly this is: Any given supply of feed produced fairly evenly throughout the year, as a rule, is of decidedly more value than would be the same supply of feed produced principally in but a few months of the year. And, as a corollary, a ton of high-quality feed produced when there is a shortage of such feed is of more practical value than a ton of similar feed produced when there is abundance of it. For example, a ton of leafy feed in February, when there is often a shortage of it, is likely to be of more practical value, although it has the same nutritive value, as a ton of similar feed in October or November, when there is abundance of such feed.

From this it follows that while the amount of production and the unit cost of production of feed on grass-farming are of fundamental importance they, by themselves, do not fully indicate the standard of efficiency being attained—the quality as distinct from the quantity of the feed and the season of its production play a considerable part in this.

From the above generalizations there emerge two questions of current practical moment. What can be done to reduce steminess in feed in summer? What practices beget the greatest amount of leafy feed in summer?

In February, mowing of pastures may be advisable to "top" portions of pasture growth which are coarse or producing seed in order to induce freer and more ready development of fresh leafy growth from the base of the topped plants. If there seems a likelihood of dry conditions for any considerable time after such topping it should be carried out at a height which will serve to remove the woody or coarse portions, and at the same time leave lower leafy portions of the sward undisturbed: this makes it advisable to cut at a considerably greater height than is adopted in ordinary mowing. It should be borne in mind that over-defoliation of the sward at this stage, whether by the mower or by grazing stock, may readily be more undesirable than the weakness that judicious removal of stemmy or coarse growth is fitted to correct: a supply of coarse feed, with all its various shortcomings, is unquestionably superior to the lack of feed that may result from close defoliation followed by an extended dry spell. The aim in practice should be the adoption of a suitable middle course which will obviate

both the evils associated with uncontrolled growth and those with excessive defoliation. This calls for removing stemmy growth without so impairing the covering of the ground as to lead to drying-out of the soil, and without so reducing the processes of plant nutrition which vary with the amount of leaf-surface as to make the process of recovery in rate of growth unduly slow.

Apart from its function in the control of pasture growth, topping may be advisable in the case of pastures overrun with large numbers of such shade-creating weeds as spear thistles, docks, fat-hen, and red-shank or willow weed. If such weeds are not checked they are likely to weaken greatly pasture plants in their immediate vicinity and possible to destroy them, and so beget vacant patches on which inferior plants later may become established ; but if they are mown these weeds create much less shade, by which the valuable pasture plants are injured.

Suitable top-dressing, which almost always, if not always, involves the use of phosphatic material, in the latter part of the summer or in early autumn, is also likely to increase leaf-production in a profitable manner. When rainfall is adequate the application of phosphates at this time quickly stimulates growth, while if dry conditions follow the application of the phosphates then beneficial effects largely will be deferred but not lost. In addition, the influence of such top-dressing not only strengthens the winter feed position but also continues during the following spring and summer when the growth will not be so markedly stimulated as if the top-dressing were carried out in winter. In short, a top-dressing of phosphates in the summer or early autumn tends not only to give more leafy feed shortly after its application, but also to bring about a more even rate of growth throughout the year, and thereby make easier the task of keeping the pastures suitably controlled

Both the topping and the top-dressing described above are together far from sufficient as means of securing satisfactory quality and evenness in the supply of feed from pastures throughout the year. Indeed, they are but auxiliaries to systematic grazing management, which calls for alternate grazing and spelling of pastures along the lines which have been described previously in these notes, and about which information may be obtained from local officers of the Fields Division.

Relation between Top-dressing and Composition of Seed Mixtures.

Increased experience with and knowledge of the role of top-dressing has necessitated, within recent years, a revision of the composition of the pasture-seed mixtures recommended for certain circumstances. For generations prior to this the natural fertility of the soil was a dominant consideration in determining the composition of pasture-seed mixtures. But now in regions of satisfactory rainfall (probably an annual rainfall of 30 in. or more), because of the possibility of employing top-dressing as a handmaid, the initial plant-food supply of the soil is at times not of as much moment relative to the seed mixture as is the top-dressing programme it proves practicable to adopt. In other words, it often proves more profitable to bring the fertility of a soil up to the requirements of a high-class seed mixture by suitable top-dressing than to utilize a seed mixture with requirements as low as the natural, unimproved fertility of the soil. In illustration of this, in good rainfall districts, land which naturally gives satisfactory support only to pastures in which brown-top is dominant has been sown successfully in mixtures giving swards in which perennial rye-grass, cocksfoot, and clovers are thriving in consequence of judicious top-dressing. Because of such results seed mixtures which for long were accepted as suitable have been discarded or amended to reflect the role that top-dressing may play in certain circumstances.

Avoidance of some Causes of Poor Results in Sowing down.

The preparation of the ground for the autumn sowing of pastures is an important summer task which should be commenced early enough to avoid unduly late sowing or loose lumpy seed-beds, both of which, even from really good seed, beget unsatisfactory "strikes," especially in the case of clovers.

In districts in which the ravages of the grass grub may be serious it is inadvisable to sow pastures after a cereal or a crop of grass—the eggs from which the grass grubs are hatched are laid near the base of plants mostly in the period from November to January, and the more bare of plants the land is during this period the more likely is it to be free of grubs during the following year.

Some of the causes of poor results in the establishment of permanent pastures were discussed at some length in last month's notes, portions of which are of timely interest.

Seasonable Work in Crop Production.

All crops sown in rows wide enough apart to allow of it usually respond profitably to intertillage as long as it is possible to work between the rows without any considerable injury to the foliage. It cannot safely be said definitely how often such intertillage should be carried out—it serves not only to suppress weeds, but also to conserve the moisture in the soil through the action of a loose surface layer of soil. On certain soils, if intertillage is followed by a heavy beating rain, then the resultant caking of the surface may make the intertillage again desirable to maintain a continuously loose surface.

If the prospective supply of feed for periods of scant grazing is not satisfactory valuable work in forage production can be carried out during the coming few weeks. In many localities there is still time to sow turnips Green Globe generally proves suitable for sowing at this time; swedes are less satisfactory for late sowing, this being partly because of greater possibility of serious ravages of insect pests especially under dry conditions.

In many instances there becomes available vacant land on which specially useful forage crops may be grown. For instance, following oats good results may often be obtained by sowing Italian or Western Wolths rye-grass and red clover—a crop which will provide autumn and winter feed. Black barley sown at the rate of 2½ bushels an acre may be expected to develop rapidly enough, under normally favourable conditions, to provide useful feed for dairy cows or sheep in about eight weeks. Often it can be sown suitably immediately after oats, and if sown in February provides feed at a time when it is frequently desired. Algerian oats are very useful for later use. With all these crops it is usually profitable to apply from 1 cwt. to 2 cwt. an acre of superphosphate.

Young lucerne which was sown in November or December is often fit for mowing in February. It is not desirable to be in a hurry in carrying out this mowing, however, unless fresh shoots are developing from the bases of the lucerne plants or weeds are tending to "choke" them, for the early stage of the lucerne can be spent more usefully in building up sturdiness and an extensive root system than in renewing foliage. Many successful stands of lucerne are top-dressed regularly with phosphates in summer. The benefit of such top-dressing is, for some time at least, received exclusively or almost so by the lucerne, whereas the benefit of spring top-dressing may be shared by the lucerne with plants such as rye-grass, which, as weeds in the lucerne, it is desirable to suppress.

The Utilization of Crops.

In the North Island farmers engaged in the production of fat lambs usually put out the rams at the end of February or in early March. If the ewes are likely to be too fat they should be put on short rations early enough to have reduced their condition sufficiently. Investigations have shown that the highest numbers of lambs are secured when ewes are in moderately good condition which is improving at the time of mating, and in this connection flushing the ewes for about ten days before the rams go out is of known value Flushing can be effected by providing some succulent feed such as fresh, short, leafy pastures or rape after the first feeding-off of the lambs. It is possible to obtain the benefit of flushing of ewes that are becoming too fat by keeping them on suitably inferior rations up to within about a fortnight of putting them to the ram, when flushing as mentioned above may be carried out.

Even in the most favoured districts February feeding is often a critical phase of the work of the year in dairying. It has been observed that when good feeding is practised in February the rate of decline in production is not dissimilar from that of January, but often it is more than twice as great as that of January, and investigation has disclosed that the cause of this normally is faulty feeding. Sometimes, especially in an unfavourable season, the feed in February is deficient in quantity, but more often the deficiency is in quality: the feed may be suitable for maintaining or even for fattening stock, but not of the quality required for the best production from reasonably good dairy cows, and the better the herd the more will its production suffer from such feed. Feeding suitable for maintenance or fattening rather than for butterfat production results when stock are fed on pasture that is stemmy and mature, or on overmature special crops such as green maize or millet, or on silage made from grass that was mown at the stage when hay crops generally are mown. The development of flower-stalks on any of the crops mentioned indicates that the crop is beyond the best stage for feeding for the production of butterfat.

One of the principal means of avoiding faulty February feeding in dairying is the keeping of the pastures leafy This often is far from easy in practice, and when it cannot be done satisfactorily help should be sought from other practices—*e g.*, the feeding of soft turnips, of young millet, of succulent lucerne, or red clover, and the leafy aftermath on pastures utilized for early ensilage. At times there may be an inclination to defer the feeding of turnips and of green cereal crops until a greater yield has been obtained, and because of this it should not be overlooked that yield alone does not determine the cash returns from a special forage crop. For instance, a soft turnip crop of 15 tons an acre used during the critical February period may eventually give a greater cash return than a crop of 25 tons an acre available when there are ample supplies of other feed. The explanation of this lies in the fact that from an unnaturally heavy decline in production in February a herd normally does not recover completely for the remainder of the producing season, so that such a decline affects the returns not merely of February, but of several other months.

Some Aspects of Weed Control.

Summer, the season in which the trouble caused by weeds is particularly obvious, is also the season in which attention can usefully be given to the planning of measures which will assist in bringing about better control of many serious weeds. To fit its peculiar conditions, especially economic and labour ones, New Zealand farming has evolved means of weed-control that depart in important respects from the measures that are often followed in some other countries. For instance, apart from some notable exceptions, weeds are not often dealt with, on a farm scale, by methods of direct attack such as hand-pulling, summer fallowing, and spraying, which received

prominence in advice tendered to farmers in other countries. On the contrary, New Zealand farmers quite frequently with success adopt an indirect type of attack which often is based on the conception of adjusting interaction between crops or crops and stock on the one hand and weeds on the other hand in such a way that the crops are not seriously affected by the weeds. In this, much valuable use is made of the principle of controlling the light-supply. Plants, whether they be crops or weeds, need a full supply of direct sunlight to enable the food-manufacturing processes which govern growth to go on in a satisfactory manner. Frequently the injurious effect of weeds is due not so much to depriving the crop of plant-food materials and of moisture, though this is important, as to cutting off the supply of light at the very period of growth, when light-supply is of most importance. Often it is possible to proceed successfully on the principle of turning this fact against the weeds by enabling the crop to win in the race for direct light.

The classical instance of the application of this principle is the growing of special " smother " crops—crops which grow quickly and densely, such as oats and vetches, or oats and Italian rye-grass, or Italian rye-grass and clover : smother crops of this type, assisted by a preceding period of summer tillage, exerts a considerable weakening influence on perennial twitchy weeds such as sorrel, couch-grass, creeping fog, yarrow, and brown-top. If after treatment of this sort such weeds are still troublesome they can be further weakened by growing a well-nourished, well-tended, dense forage crop, such as chou moellier, rape, or mangels, which by its further smothering influence tends to reduce the weeds to impotence. In view of the value that at times has been attached to bare summer fallowing, it is to be noted that in the above practice summer tillage instead of being the main means of dealing with twitchy weeds is merely an auxiliary to a judicious series of crops. It is now realized that, while summer fallow may at times eradicate twitchy weeds, it requires so much labour that it is too expensive, and, further, that under many conditions, especially where the summer rainfall is satisfactory for general farming, no matter how much labour were devoted to summer fallow, by itself it would not be effective. In short, summer cultivation, while far from valueless in the destruction of weeds, can, as a rule, be employed effectively only when linked with crop-management that begets a prolonged and dense shading of the twitchy weeds.

The principle of controlling the light-supply may also usefully be employed when planning the future cropping of land, especially in the South Island, which is known to be infested with the seeds of weeds which germinate in the spring rather than at other times—*e.g.*, fat-hen, spurrey, nightshade. Cropping should be arranged so that such land will be sown in the autumn, with the result that the crop is advanced enough to compete successfully for light against weeds germinating in the spring.

Although trouble from such weeds can be avoided in this manner for one season, the land does not thereby become free from the seeds of the weeds, many of which remain viable in the soil for years, and so it is often advisable to put land heavily infested with such weeds in pasture and to keep it in pasture, especially if the pasture is a satisfactory one, as long as it is practicable to do so.

Another application of the principle of controlling the light-supply is of value against several serious weeds of pastures. The experience of several farmers in the controlling of rushes illustrates this aptly. In these cases in which the presence of the rushes has not been due essentially to bad drainage the farmers begin the attack by mowing the rushes about or shortly after midsummer, when the mowing seems to cause the greatest setback to the rushes. Subsequently the conditions are made so favourable to the growth of grass, by judicious top-dressing, harrowing, &c., that the grass

gradually "smothers" the weeds to such an extent that they become of no practical consequence even though they may not be eradicated. The same type of control is also applied to brown-top, sorrel, &c. An essential of success in this type of weed-control is an initial pasture which will respond satisfactorily to good treatment, and thereby develop eventually into the strong sward with vigour enough to outgrow the weeds. If the pasture is too open or weedy to allow of satisfactory strengthening, then normally the best course on arable land is to plough it up and resow in suitable permanent species.

From the above statements it becomes evident that two outstanding features of economic weed-control in New Zealand are (1) indirect attack based on the principle of controlling light-supply, (2) the adoption of methods which "pay as they go." Unfortunately the control of all weeds does not conform to the application of these conceptions, which, however, could be exploited more extensively with advantage.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Seasonable Spraying.

The last application for the season of the combination spray for the control of chewing insects and fungous diseases on pome fruit-trees needs to be made much later in some seasons than in others. In certain districts, and when weather conditions are favourable, an application made at the end of January will often effect a satisfactory control for the remainder of the season. However, when there is sufficient rainfall in February or early March to wash an appreciable amount of the spray residue from the fruit, or when damp humid conditions are experienced during this period, it becomes necessary to make one or two further applications later in the season. During the season just past there was, in certain districts, considerable rainfall in February, which produced ample evidence in the form of black-spot, codling moth and leaf-roller injury, &c., that further applications of the usual combination spray could profitably have been applied in late February.

Picking Fruit.

The utmost care in picking is essential if the fruit is to be marketed in the best possible condition. Unfortunately, this phase of orchard work is sometimes left to inexperienced pickers, without proper supervision, resulting in much of the fruit being injured. In fact, it is suggested that more damage is done to the crop in picking than in any other single operation. Complaints are frequently made regarding faulty grading-machines, careless or inefficient packers, lack of care in operating the lidding-press, rough handling in transit to market, &c., and no doubt in many instances there is need for improvement in these operations; but if the fruit is injured in picking no degree of after-care will place it on the market in perfect condition.

The bumping of the picking bag against the ladder or limbs of the tree and the careless emptying of the bags into the field boxes probably account for most damage during picking. Other faults that only too frequently occur are pulling the stem out of the fruit, dropping fruit on to the ground—often caused by trying to pick a second fruit when one is already held in the hand, dropping fruits into the picking-bag and the overfilling of the field-boxes. All of these operations require constant supervision, even when experienced pickers are engaged in the work. If

the orchard-owner (or manager) is unable at any time to remain with the pickers, then a competent foreman should immediately take over the supervision.

Maturity of Pome Fruits.

To determine the degree of maturity fit for picking in apples and pears requires an intimate knowledge of the varieties and expert judgment on the part of the pickers. The first picking of the season from any variety is wherein the most difficulty obtains. Some of the methods in use for ascertaining the right stage of maturity for picking are: The iodine test, which for various reasons cannot be recommended. Likewise the mechanical pressure test is equally unsuitable for general field-work. The colour chart method has a limited use; on the colour chart are three disks—leaf-green, green-yellow, and chalcedony yellow. These colours are reported to correspond with the ground-colour of an immature, just mature, and overmature Jonathan apple. Each colour disk is perforated with a large hole, and to determine its maturity the apple in question is pressed against the hole and the ground-colour matched. While this chart may be of some value for certain varieties, it is obvious that many other varieties would require different colour charts. The colour of the pips is a definite indication in some instances, but as the amount of browning necessary to indicate the degree of maturity necessary varies with most of our principal varieties, no colour standard can be set for all or even most varieties.

Another method sometimes employed with apples is to cut the fruit with a knife—if the sap follows the cut the apple is deemed to be mature. On the other hand, if the cut remains dry, the apple is considered immature. The usefulness of this method is very limited on account of the variation in the different varieties.

It is suggested that the two most dependable guides in this direction are the changing of the ground-colour and the freedom with which the fruit is separated from the spur. In the case of the former an intimate knowledge of the variety as regards ground-colour changes is necessary to select the just-mature fruits at a glance, yet with experience this can be done fairly accurately. With pears the latter method is more simple and fairly dependable, although no doubt with both apples and pears pickers should give due consideration to both ground colour and freedom of release.

Red-mite.

There are at least two species of red-mite common on apple-trees in this country. The more common of these two is commonly known as the European red-mite, and the other, clover-mite. A brief account of the life-history of the former, as worked out in New Zealand, is quoted to enable growers to better understand the importance of spraying at the periods recommended in these notes for December last.

The winter eggs hatch in September and October. The approximate period from hatching to adult occupies, in the female 12·5 days, and in the male 11·7 days. The pre-oviposition period is 3·5 days. The average number of eggs laid by each female is approximately sixteen; average length of life of female, 17·6 days at least. Laying of winter eggs takes place from the end of January into April. The winter egg appears to be different fundamentally from the summer egg, and the former is laid by a special generation which lays this type only. The incubation period of the summer eggs is, on the average, 11·7 days. It is possible for eight generations in a season, but it appears more probable that four or five generations would occur under average orchard conditions.

From a study of the above, it is evident that it is of the utmost importance to prevent the laying of overwintering eggs, as all of these eggs cannot be killed by the application of winter oil, even at a dilution of 1–9. The

application of summer oil destroys the mites, but does not prevent many of the summer eggs from hatching. As the mites commence to lay winter eggs from about the end of January, it follows that this is a suitable time to make the first application of summer oil. The period from hatching to adult being, on an average, about twelve days, it is evident that the second application should be made about ten days after the first, thus preventing the mites reaching the adult stage and laying winter eggs Where this practice is carried out thoroughly, there should be extremely few winter eggs to commence the infection the following spring.

Manuring Cover Crops.

No matter what cover crop is being grown, the application of some fertilizer at the time of sowing the seed is advisable. For leguminous crops, superphosphate at the rate of 2 cwt. to 3 cwt. per acre is suitable for this purpose and considerably increases the growth.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

With the continuance of dry weather trees will be retarded and possibly suffer a loss of foliage. This should bring home to growers the necessity of making provision for periods of dry weather. The first essential is a system of thorough cultivation from the early spring onwards, and if this has been neglected doubtless the trees will be suffering. It is very difficult to outline a definite system of cultivation that would meet all seasonal conditions; nevertheless, growers who have had years of experience should have sufficient knowledge as to what should be done in order to obtain the best results.

It is advisable to carry out all seasonal operations as they become due, paying attention to spraying, pinching, &c., that may be necessary from time to time, and that have been described in previous notes.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Cleaning the Quarters.

It may be well to emphasize again the great importance of thoroughly cleaning the quarters where adult stock have been accommodated and the young pullets are to take their place. There are few houses where old birds have been kept which are quite free from vermin, and it is only placing the pullets at a great disadvantage to introduce them to lice-infested quarters. Because vermin cannot be seen in the house during the day, it does not necessarily mean that they are not present. The most dangerous of parasitic pests which affect poultry torture the birds by sucking the blood of the birds at night, harbouring by day in the cracks and crevices of the house. A good means of thoroughly cleaning out vermin and destroying the germs of disease which may lurk in cracks and crevices is to first give the whole of the interior of the houses a good coating of tar, which, when thoroughly dry, should be followed by an application of white-wash. This will have the effect of covering up all hiding-places for the vermin, so that when the spraying with a disinfectant takes place this may be thoroughly effective. Spraying with disinfectants is often condemned as not being sufficiently strong to effectively destroy vermin. This is not necessarily the case, as too often the spraying materials are strong enough, but the trouble is they do not reach many of the crevices and cracks where the insects swarm most thickly. Some seem to think that by giving a house a rest for a few weeks the vermin are destroyed by starvation. This is a great mistake, for the writer has seen a house which had not had a fowl

in it for many months badly infested with red-mite, and this during a cold winter season in Otago. It may be mentioned that when gorged with the blood of the fowl the mite has a deep red appearance, but when fowls are not present it is grey in colour. Obviously lice are a constant drain on a fowl's vitality, and when these pests are numerous a bird is prevented from resting in comfort at night, and in addition, with its life blood being drawn away from it nightly, is unable to make the best use of the food it consumes. It is comparatively easy, by observing proper cleanliness, avoiding over-crowding, and having well-ventilated houses, to prevent red-mite from ever making an appearance in the poultry-house. Only those who have had experience in combating the pest when it has gained a good foot-hold can realize how much better it is to prevent than to wait until it becomes necessary to cure.

Ovarian Disorders.

Judging from complaints received, the desire to secure a big egg-yield has led several poultry-keepers to overforce their birds with boiled meat, meat-meal, &c., and ovarian troubles, such as protrusion of the oviduct, are a natural consequence. A liberal supply of nitrogenous material is essential to heavy egg-production, especially during the colder months of the year, but there is a danger that this may be carried to excess during the spring and summer months, which are the natural breeding-season for bird-life. The rich forcing foods, such as meat or its substitutes, should therefore be fed with caution at this period of the year, especially where the birds have a free range, and thus have an opportunity, especially after rain, of picking up much animal food in the form of worms, &c. Not only does an excessive supply of a forcing ration tend to bring on ovarian disorders, but it induces the production of thin-shelled and double-yolked eggs, and also those containing blood-spots. The chief danger in feeding a heavy meat ration is where this material is mixed with the morning mash, and the latter is fed to all members of the flock irrespective of their age and whether or not they are in a laying condition. The oversupply of meat food is specially accentuated where the supply of grain material is not as liberal as it should be, which often happens owing to the poultry-keeper's incorrect reasoning that an extra supply of concentrated meat food will make up for the inadequate supply of grain. It will usually be found a wise course, especially where a large flock of birds is concerned, to feed highly nitrogenous material such as meat-meal sparingly in the morning mash, but there is no objection to its being always available for the birds to pick at in a separate hopper. In this way ovarian disorders will be reduced to a minimum, as the bird is given an opportunity of balancing its own ration according to nature's dictates, and she can usually be relied upon to do this better than we can do it for her. Usually, when a bird becomes affected with protrusion of the oviduct, hæmorrhage to a greater or lesser extent sets in, with the result that the other birds in the flock will pick at the bleeding part and often pull out the bowels and oviduct of the victim, causing a cruel death. Protrusion of the oviduct in a bird resulting from the feeding of a highly forcing ration and the other birds picking a the affected parts is not necessarily responsible for this part of the bird's anatomy being injured. It is frequently due to one or more birds in the flock acquiring the cannibalistic habit of picking at and puncturing the oviduct just when their mate is in the act of expelling her egg. As a result bleeding sets in, and once the latter makes its appearance and after the bird leaves the nest it is soon attacked by its mates, which usually results in death, and, as is the case with protrusion of the oviduct, dead birds may be frequently found in a house where other members of the flock have pulled out and eaten the greater part of the oviduct and intestines. When a bird is on the point of expelling an egg, the body is raised and the oviduct protrudes more or less, and presents a highly flesh-coloured appearance. The latter condition

no doubt induces the culprit in its desire for animal food to pick at and puncture this delicate organ. Where birds have acquired this vice, the only course is to deepen the nests and arrange them in such a way that the oviduct of a bird cannot be seen or picked at when in the act of laying. Careful observation will often locate the culprit, which is frequently seen standing at the front of the nest-boxes waiting for an opportunity to satisfy its cannibalistic inclinations. It goes without saying that such a bird, if detected, should be immediately got rid of, as it is surprising how soon one bird will teach its mates the habit.

Referring again to vent-picking, it may be well to mention that such is often the result of a hen picking at the vent of another bird when the latter is in the act of excreting. This trouble is most common when birds become constipated as a result of being insufficiently supplied with green food, or with green material that has reached a decidedly fibrous stage. In such cases when the bird is excreting the anus protrudes and the red-coloured flesh thereof attracts the culprit. This is a very bad habit, which causes much mortality, especially among pullets when commencing to lay. Succulent green material fed in abundance and a hopper of meat-meal placed within reach of the birds at all times to pick at will do much to check this habit.

Generally, when ovarian disorders or vent-picking takes place in a laying flock, the owner assuming that the diet provided is of too rich a nature and is responsible for the trouble, and as a means of checking it eliminates forcing-foods by degrees from the ration, but in many cases, instead of the trouble being reduced, it is increased. The birds have acquired the vice of picking each other, and, being in a productive condition, they naturally crave for animal food and pick at the vents of their mates in their endeavour to secure it The worst cases of this kind that have come under my notice have been where flocks of pullets gave evidence of coming to lay at too early an age and, as a means of checking this, all forcing food was suddenly withdrawn from the ration. True, a heavy meat or milk ration will encourage early maturity, which is undesirable; but of what avail is it to check this by eliminating all forcing-food from the ration if as a result much mortality takes place due to vent-picking, &c.

Corns.

It is sometimes difficult to make people understand that a common cause of birds becoming affected with foot troubles such as corns, &c., lies in having the perches too high. It is contended that in a state of nature a bird will fly into trees and come down again without injuring the feet. The fact is overlooked that out in the open a bird can spread itself in a natural manner, and is therefore able to land gently on the ground, running as it alights to break the force of the landing. In the fowlhouse, on the other hand, the bird loses all the advantages of its wings in its descent and thereby jumps to the ground, the whole weight of the body having to be borne by the legs. Especially does this apply when the one wing has been cut to prevent it getting out of the rûn. The heavy landing of birds compelled to jump down from a perch to the hard floor is not only a frequent cause of disorders of the feet, especially corns, but is obviously not to the advantage of the high-type layer in the flush of her laying period. Furthermore, a breeding-pen rooster that has contracted corns is generally of little use. High perches are not always responsible for corns on the feet. They are sometimes caused by compelling the birds to exercise on hard or stony runs, or by a prick from a thorn when the birds are on free range, or when thistles, pieces of gorse, &c., have been among the litter used in the houses.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Extracting.

EXTRACTING should now be in full swing in all districts of the Dominion. Where operations for any reason have been delayed, care must be taken to see that the bees are not crowded out or they will commence to loaf, and the ultimate crop will be small. It is a good policy to extract twice during the season; but where the beekeeper prefers to leave the work until the end of the flow a close watch should be kept so as to provide ample room. This, however, can only be done where large numbers of spare combs are on hand. It is during the season when honey is coming in freely that the beekeeper realizes that his most valuable asset, next to his bees, is a good stock of extracting-combs. Every effort should be made to get at least twenty spare combs for each hive in the apiary, and with this number always on hand the bees are not likely to be hampered for room.

In the absence of plenty of drawn-out combs the best plan is to keep the extractor going, and thus prevent the bees from blocking the brood-combs. The blocking usually happens unless ample room is provided, and as a result the queens are prevented from laying to their utmost, and the colonies dwindle. At no time during the working-season should the work of the queen be hindered. Care must always be taken to see to this important item during the flow. The honey is quite ready for extraction when the combs are three parts capped, but great care must be exercised not to extract unripe honey. Numerous instances have come under my notice where the practice of taking unripe honey has meant a total loss to the beekeeper.

Strainers.

It is not uncommon to find exposed for sale honey with which proper care and attention have not been paid to straining at the time of extracting. Nothing hinders the sale of extracted honey so much as a layer of wax-particles, dead bees, &c., and it is surprising how few beekeepers take the necessary trouble to see that their product reaches the customer free from impurities. In no case should honey be run direct from the extractor into the containers: it should be properly strained. It is the attention paid to this necessary detail that aids in the sale of the crop, and when honey is properly treated it readily commands a higher price. Fine-gauge wire strainers are usually adopted, but even these are not sufficient to remove the smaller wax particles. In order to ensure perfect condition, the honey should be passed through good fine cheesecloth before being run into the tank. Cheesecloth strainers are excellent, cheap, and easily made, while at the same time they can be cleansed readily. They remove everything but the smallest particles of wax, which should be finally disposed of when the honey is skimmed. This latter process is an important one, and should always be carried out before the honey is put up in marketable form.

Testing Honey for Ripeness.

Before tinning-off the honey the apiarist should make sure that it is ripe. Fermentation is sometimes quite a serious problem, and yearly large quantities of honey which were thought to be well ripened at extracting-time ferment, more especially when left over till the weather becomes warm. The bulk of our honey is exported, and a matter of first importance is its condition on arrival at the overseas market. Usually beekeepers experience little difficulty with low-specific-gravity honeys if care is exercised and only well-sealed combs are extracted from. However, to ensure that the honey is up to standard it should be tested with a hydrometer before being run into the tins.

When making the test the contents of the tank should be gently paddled in order that the honey may be of the same consistency

throughout. This operation is of importance, as there is always a risk of variation of the specific gravity of the honey at the bottom and top of the tank. If on testing with a Twaddle's No. 4 hydrometer the instrument does not sink below 84 a well-ripened honey is indicated. This is equal to a specific gravity of 1·42 when the test is made at a temperature of 60° F. As the temperature of honey in summer rarely sinks so low, the test may be taken at from 70° F. to 80° F. by adding one point to the hydrometer reading for each 10 degrees of heat over 60° F. Thus, if the hydrometer sinks to 82 at a temperature of 80° F., it would register 83 if taken at 70° F. and 84 if taken at 60° F. To arrive at the specific gravity multiply the hydrometer reading by 0·005. Thus $84 \times 0{\cdot}005 = 0{\cdot}420$; add 1 for the specific gravity of water and it will equal 1·420. This method is reliable only up to a temperature of 90° F.

Testing Thick Honey.

Sometimes the honey is so dense that the hydrometer will not sink. When such is the case take equal parts by volume (not weight) of honey and water, mix thoroughly, test with a No. 2 Twaddle's hydrometer, and then multiply the result by 2. This will give the same result as if taken with a No. 4 instrument by the direct method. Thus, if the No. 2 instrument sinks into the honey and water to 42, this multiplied by $2 = 84$. Perhaps the quickest and simplest method for testing thick honey is to have a deep glass or beaker on which is a mark to contain about 4 oz. of water. Fill up to the mark with water, then pour it into another vessel; now fill up to the mark with liquid honey, add the water previously measured, and mix thoroughly; then place in it the No. 2 hydrometer, note the number to which it sinks, and multiply by 10, place the decimal point before the result and add 1. Thus, if it registers 43, $43 \times 10 = 430$; place the decimal point before the $430 = 0{\cdot}430$, to this add 1, which is the specific gravity of water, and the result will be 1·430.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

THE successful production of vegetable crops depends very largely on timely cultivation and weeding during the early stages of growth, therefore crops recently sown or planted should receive light cultivation whenever it is necessary to break up the surface crust to retain moisture and destroy weeds in the rows or between them. The dry weather usually experienced at this time of the year facilitates this work, and every effort should be made to take full advantage of this opportunity of cleaning the land. The crops will make maximum growth in clean ground and mature rapidly as soon as the flush of growth takes place with the coming of autumn rains. This may be rather a trite instruction, but, unfortunately, the neglect of the thorough performance of these operations is a common cause for poor results.

Autumn rains will check some of the insect pests, but, unfortunately, they have little effect on the white butterfly. In most districts cabbage, broccoli, and cauliflower crops will require the protection of the dusting treatment until the plants commence to heart up. It should then be discontinued in favour of an occasional spray, when required, with a salt or soap solution. These solutions are made by dissolving 2 oz. of soap or salt in 1 gallon of water. In some districts the white butterfly pest has been greatly reduced, no doubt as a result of the parasitic insects introduced by the Plant Research Station, but the crops mentioned still need protection. The butterfly practically disappears towards the end of the month of April, which means that egg-laying ceases, and clean crops will

complete their growth without interference; but on infested crops the larvæ, which have considerable resistance to the lower temperatures, will continue their destructive attack until well on into the winter.

The harvesting of potatoes, onions, and other crops should be given prompt attention as soon as they are ripe, especially in warm humid districts where a second growth takes place very rapidly. In dry districts the curing of onions is facilitated, but the potato moth frequently levies a heavy toll under such conditions Losses from this attack will be prevented if potatoes are bagged up the same day as they are dug and not left exposed for this night-flying moth to lay her eggs upon them. Infected shaws should be burnt, and small potatoes should not be left exposed to carry over the infection. Potatoes in the ground will not become infected if they are moulded up well, unless they are allowed to remain in the ground some time after the tops have died down, when, in the absence of the tops, the moths will seek out any accessible tubers. If these infected potatoes are included when bagging up, the results are generally serious, as the pest continues to increase and flourish for a long period in the shelter of the store.

The problem of maintaining a supply of humus in ground devoted to intensive cropping is very pressing; in the absence of a sufficient supply of farm or stable manure, growing green cover-crops is the main alternative. As a generous supply of humus is a fundamental necessity, land should not be left bare after harvesting, but lightly cultivated and sown down at once with mustard, oats, barley, or beans--any crop that will make rapid growth at the season and during the time the land can be spared for the purpose. In any case the production per acre is decidedly limited as compared with the needs of the land, so that it is usually necessary to take advantage of every opportunity for growing green crops for turning under. It is also an excellent method of smothering out weeds which, we are now beginning to learn, are responsible for many more injurious effects on crops than merely that of competition with which they are generally charged. As hosts for insect pests and many plant-diseases, some of them carry over the trouble from year to year when it would otherwise die out; or they are a source of contagion that is easily overlooked.

As the celery crop apprpaches maturity it is necessary to blanch the stems by excluding the light; for ordinary varieties this takes about six weeks and about half that time for self-blanching varieties. Where it is grown in trenches on account of dry conditions, the side shoots and dead leaves should be removed, the trenches generously watered, and any nitrate of soda or other manures required should be applied. When the plants are dry they should be lightly tied and soil, well pulverized, should be filled in round them to a depth of 4 in. or 5 in. The moulding-up is completed in two more operations of this kind performed in dry weather at intervals of about a fortnight. For self-blanching varieties grown in blocks on the flat in moist land, it is necessary only to place 12 in. boards on edge close up around the sides of the block to blanch the sticks effectively.

On well-drained soil in a sheltered position crops of cabbage and sometimes cauliflower may be planted out about the month of April for spring cutting. For these crops the seeds are sown during the month of February; spinach and lettuce for winter use may also be sown; and, in the colder localities, tender mild onions of the Rocca or Tripoli class for salads, and planting out in spring; in warmer districts this sowing is usually made towards the end of March.

Cleaning up the Glasshouse.

Scientific research during the last few years has demonstrated the necessity of keeping the glasshouse and soil biologically clean and indicated methods of doing it effectively The facility with which good crops may be grown in new glasshouses is a matter of fairly common experience and plainly

endorses the need of an annual clean up, especially in houses where the same kind of crop, as tomatoes, is grown for many years in succession. For all operations of this kind results depend on systematic, thorough, well-timed treatments; badly regulated efforts are merely a waste of time and money.

The harvest of the tomato crop under glass being completed, the house is fumigated, during an evening without wind, by closing it tightly and burning sulphur in small heaps on the floor, and leaving the house closed for twenty-four hours. Sulphur is burnt at the rate of 2 lb. per 1,000 cubic feet of space in the house, placing it in five or six heaps to facilitate the distribution of the gas. The stems of the plants are then cut a few inches above the ground, and when they have dried somewhat the tops of the vines are cleared and plants and strings are taken out and burnt, as are the roots after carefully lifting them with a fork. The experience of the past season, and inspection of the roots when lifting them will afford a very good knowledge of the conditions as regards diseases and pests that may be present, and upon that knowledge the further treatment necessary may be decided and carried out while the house is empty and strong remedies may be applied. The house should be cleared of everything movable and swept down as necessary. This will be all the more effective if wall-plates are bevelled and the woodwork is properly painted. Level plates and crevices afford easy lodgment for pests and diseases, so should be avoided as far as possible. Pipe draining may be considered where the land is heavy; there are no doubt instances where a properly installed system would give greatly improved results. Under ordinary conditions a dressing of naphthalene, 4 oz. per square yard, thoroughly dug in and a cover crop sown down a week or two later will meet the position. Every few years the soil should be removed to a depth of 12 in. and replaced with good fresh loam or the soil sterilized with steam. There are indications that steaming the soil annually is an unnecessary expense and decidedly injurious. Where there are a number of houses, one or two may be treated each year so that each will receive this attention about every four years. As sterilization results in the liberation of considerable quantities of plant-food, it is unnecessary to apply organic nitrogen to the soil for the next crop in the houses receiving this treatment. Attention should be given to the vicinity of the glasshouses, frames, and tool shed, as reinfection readily takes place if these are neglected.

Planting Strawberries.

In warm localities in the north planting is done towards the end of autumn with good results, but elsewhere it is generally best to set out the plants in early autumn as soon as the young plants are available so that they are well established before the winter season. Soil suited for this crop is heavy, deeply worked, moist but well drained, and quite free from bad perennial weeds; the situation open but warm. With a heavy dressing of blood and bone manure and superphosphate ploughed under, the plants may be set out with good prospects of a satisfactory crop. As with other kinds of fruiting-plants, varieties satisfactory in one district are often disappointing elsewhere. Those favoured in the North are Marguerite, Captain Cook, and Helenslea Surprise; while in the South, strains of Melba, Laxton's Noble, and Ettersburg are preferred. Good plants are required for the best results; they are of moderate size, well rooted, free from leaf-spot and other diseases, and of good strain; not spoiled by bad packing or kept too long out of the ground. When the surface of the ground is well graded and the soil settled firmly, the plants may be set out about 9 in. apart and 26 in. to 36 in. between the rows; the wider distance where the plantations are cropped for two or three years, especially where the matted row is favoured or horse-drawn implements are used. After planting take advantage of dry intervals to lightly cultivate the ground and destroy seedling weeds.

Laying down Lawns.

The fine lawns and greens that are sometimes seen in this country are frequently the subject of complimentary remarks by visitors from overseas. To a great extent their fine condition is due to the soil and climate which are so conducive to the best results, which, however, cannot be realized unless care and attention are given when laying them down and maintaining them afterwards. As a smooth, close sward is one of the finest features in the garden, a little care in its making and maintenance is well repaid. Those who purpose to sow down a lawn towards the end of February or early March—a most suitable period—may well consider the following points: Cultivate the soil to an even depth and thoroughly pulverize it so that it will consolidate evenly. Take the greatest care to have the surface at a suitable height and smoothly graded so that water will not lie in pools, but will drain off satisfactorily; this probably requires the most consideration and labour to accomplish. Complete the consolidation of the ground, when it is comparatively dry, by rolling it well, and rake up an even, shallow tilth on the surface. In calm weather broadcast the seed at a rate of ½ oz. to 1 oz. to the square yard, and rake it in smoothly. Different kinds of seeds are used in the various districts according to the soil and the purpose of the green, but it is interesting to note the work of the Green-keeping Research Committee at Palmerston North shows the best turfs have resulted from sowings of a grass-seed mixture consisting of one part brown-top and two or three parts of Chewing's fescue, on good alluvial soil in that locality. In many manurial trials 1 oz. superphosphate and 2 oz. sulphate ammonia per square yard, worked in before seeding the greens, gave excellent results.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: DECEMBER, 1934.

Dominion Meteorological Office.

NOTES FOR DECEMBER.

DECEMBER was a very dry and sunny month. The effect of the dry weather was accentuated by the very high temperatures ruling, but, on the other hand, was somewhat mitigated by the unusual absence of wind. It was the hottest December ever recorded in New Zealand, and no other month has exhibited so large a difference from its corresponding normal. Pastures have become parched and brown, and fruits and crops have ripened and plants flowered in an immature condition. Root crops have germinated badly in many places. The milk-yield has fallen off considerably, and lambs are not fattening so well as previously. Otherwise stock are in good condition. In North Auckland and at scattered places elsewhere, the general conditions were reversed, and there is still plenty of green pasture.

Rainfall.—The Auckland Peninsula, especially the northern portion, had a very wet month, but in all other major divisions of the country the average rainfall deficiency was large. This was particularly the case from the Wellington Province southwards. Even where heavy falls occurred they were generally of a local character, and less benefit was derived from them than if the rain had been general. In parts of the central plateau of the North Island, in the Opotiki district, and in much of Otago and Southland, conditions were better than elsewhere. The lowest rainfalls were experienced near Wellington, on the Wairau Plains, and in parts of Canterbury Several places near Wellington, much of Banks Peninsula, and the Lake Coleridge area recorded none at all.

Temperatures.—The mean temperatures were everywhere much above normal, and most places experienced the hottest December on record. In no other month since recording began has the average departure from normal over the Dominion, whether positive or negative, been so high. In numbers of districts the mean was 7° F. or more above the average. Many high individual temperatures were recorded, but the most noticeable feature was the uniform conditions with persistently high readings. The coldest spell occurred on the 9th and 10th, but minimum temperatures below 50° F. were infrequent in all districts.

Sunshine.—Abundant sunshine was experienced in most places, and several had their highest monthly total on record.

Pressure Systems.—Extremely uniform pressure conditions were experienced, with rather high readings ruling. The outstanding feature of the situation was the almost continuously high pressure to the eastward, as shown by the reports from Chatham Island. At the same time low pressure prevailed over Australia. As a result, the prevailing wind was a north-easterly, and westerlies were conspicuous by their absence. Depressions, which were deep and productive of much rain over eastern Australia and the Tasman Sea, became shallow and lost energy as they approached New Zealand. The anticyclones, except for one in the middle of the month, passed in higher latitudes than usual. There was no really stormy weather, and scarcely a gale was reported.

During the first ten days disturbed weather persisted over the Tasman Sea, a deep cyclone developing in the northern portion. As the remains of this passed by to the north very heavy rain fell in North Auckland, severe floods being experienced in the extreme north.

A shallow depression followed closely on the above, and on the 11th occurred the nearest approach to general rain. As this depression passed eastward also, the barometer at Chatham Island showed the only considerable fall recorded during the month.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1934, AT REPRESENTATIVE STATIONS.

—	December, 1934. Total Fall.	December, 1934. Number of Wet Days.	December, 1934. Maximum Fall.	December, 1934. Average December Rainfall.	Calendar Year. Total Rainfall.	Calendar Year. Average Rainfall.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	6·92	14	2·90	2·63	6·337	54·31
Russell	10·38	14	4·50	2·55	83·77	49·94
Whangarei	9·77	19	2·82	2·99	68·70	60·51
Auckland	2·38	10	0·86	2·91	43·54	44·87
Hamilton	1·20	4	0·55	3·50	40·26	49·54
Rotorua	2·96	6	1·22	3·73	51·45	54·98
Kawhia	1·36	4	0·58	3·30	44·40	53·72
New Plymouth ..	3·19	13	0·94	4·24	52·18	59·80
Riversdale, Inglewood ..	3·58	11	1·47	7·48	78·70	104·17
Whangamomona ..	5·15	9	1·40	5·63	65·66	77·55
Hawera	1·14	5	0·63	3·25	36·71	45·21
Tairua	2·42	11	0·82	4·37	54·29	64·44
Tauranga	2·27	6	1·07	3·57	52·11	52·37
Maraehako Station, Opotiki	1·04	8	0·45	2·92	43·68	53·37
Gisborne	3·40	9	1·97	2·30	28·38	45·13
Taupo .. .	2·91	13	0·58	3·12	42·47	43·87
Napier .. .	0·82	9	0·33	2·25	26·70	35 02
Hastings	1·00	6	0·44	1·88	23·45	31·86
Whakarara Station ..	2·08	7	0·65	..	45·56	..
Taihape	4·06	7	1·08	3·24	32·11	36·93
Masterton	0·05	2	0·04	2·87	32·13	38·54
Patea	0·93	7	0·45	3·52	38·71	44·81
Wanganui	0·56	3	0·48	2·69	30·94	36·11
Foxton	2·02	1	2·02	2·64	33·38	32·51
Wellington	0·05	1	0·05	2·84	43·34	41·08
			South Island.			
Westport	2·94	7	1·36	8·45	81·88	96·80
Greymouth	1·63	4	0·85	8·65	86·07	101·55
Hokitika	5·22	7	2·11	10·45	89·88	115·24
Ross	4·45	9	1·48	12·05	107·25	135·49
Arthur's Pass ..	0·90	3	0·84	14·11	145·22	161·91
Okuru, South Westland	21·75	9	6·10	10·97	..	144·47
Collingwood	0·71	4	0·59	7·97	87·65	97·40
Nelson	3·40	3	1·63	2·96	38·95	37·84
Spring Creek, Blenheim	0·70	2	0·65	2·10	30·87	30·28
Seddon	0·09	2	0·07	1·96	28·09	24·80
Hanmer Springs ..	1·02	6	0·65	3·88	49·65	45·30
Highfield, Waiau ..	0·47	5	0·30	2·64	34·21	33·28
Gore Bay	0·48	3	0·42	2·57	38·12	31·27
Christchurch	0·04	3	0·02	2·15	26·41	24·99
Timaru	0·66	9	0·28	2·44	25·84	22·64
Lambrook Station, Fairlie	0·98	7	0·36	2·57	29·62	24·87
Benmore Station, Clearburn	0·34	6	0·17	2·34	23·69	24·64
Oamaru	1·47	11	0·61	2·25	24·74	22·01
Queenstown	1·26	7	0·48	2·52	31·59	30·46
Clyde	1·15	7	0·64	1·76	17·11	15·22
Dunedin	1·73	8	0·76	3·52	40·18	36·77
Wendon	1·13	8	0·36	2·82	26·42	29·96
Balclutha	1·50	5	0·80	2·56	30·11	25·62
Invercargill	2·45	14	0·54	4·06	38·96	45·75
Puysegur Point ..	7·64	15	1·68	7·17	73·49	85·26
Half-moon Bay ..	4·08	18	0·80	4·90	47·68	58·79

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COSTS OF PRODUCING BUTTERFAT.

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THE continuance of low prices for dairy-produce has placed the dairy-farmers of the Dominion in a precarious financial position, and has caused them to consider carefully the factors which determine their final costs. In this article certain of these factors are discussed, and some standards are suggested which may give farmers a reasonable basis of comparison with their own operations. The discussion is based on 1933-34 season's record of 550 dairy-farms situated in the North Island, the data having been originally collected and collated by the Department of Agriculture on behalf of the Royal Commission which recently submitted its report on the dairy industry. Full tabular details of these farm records are contained in the Commission's report. For the convenience of readers, descriptive details of the farms and their location are given in Table 1 (next page). It will be seen that the records are grouped in well-defined districts, with a collective grouping for the Auckland Province into North and South Auckland. The averages given for the 550 farms show that the herd performances and the number of cows milked per 100 acres are above the Dominion averages for the season, and the consequent average production of 117·73 lb. of butterfat per acre is comparable with the higher grade dairy-farms of the Dominion. The distribution of these farms and their efficiency of management as measured by performance makes the group a reasonable one on which to establish standards that are surpassed or are attainable, and which should be improved upon on all specialized dairy-farms.

PRODUCTION STANDARD.

The production standard should not be less than 120 lb. of butterfat per acre. To attain this approximately forty-eight cows averaging 250 lb. of butterfat must be milked per 100 acres of land farmed. If this production standard were attained the Dominion's 1933-34 season's output of 427,000,000 lb. of butterfat would be produced by milking 1,700,000 cows on 3,560,000 acres, instead of 1,816,000 cows on approximately 5,000,000 acres as was the case.

Table 1.—Analysis of 550 Dairy-farms showing Production, Costs, and Capital Position.

—		Northern North Auckland.	Eastern North Auckland.	Western North Auckland.	Southern North Auckland.	North Auckland.	Northern Waikato.	Mid-Waikato.	Eastern Waikato.	Tauranga.	Bay of Plenty.	South Auckland.	Taranaki.	Wanganui.	Manawatu.	Pumice Area.	Gisborne.	Wairarapa.	North Island.
Number of farms	..	25	26	30	34	115	30	42	31	11	30	144	86	38	73	29	31	34	550
Number of cows .. .	..	1,315	1,489	1,746	1,792	6,342	1,439	2,670	2,533	918	2,374	9,934	5,138	1,687	3,754	1,765	1,353	1,663	31,636
Average butterfat per acre .	lb.	74·93	90·43	107·30	98·42	92·98	131·49	140·54	165·91	118·49	145·10	143·69	121·05	109·06	133·94	85·35	110·61	104·78	117·73
Average butterfat per cow ..	lb	211·3	223·0	225·5	239·8	226·0	272·0	266·1	206·6	231·5	259·9	263·2	278·3	256·6	271·2	221·5	227·6	245·2	254·0
Average cows per 100 acres	.	35·45	40·54	47·58	41·04	41·14	48·34	52·81	61·54	51·19	55·82	54·60	43·50	42·50	49·39	38·52	48·60	42·74	46·35
Average butterfat per labour unit	lb	4,791	4,813	4,500	4,775	4,708	5,513	5,872	6,566	5,902	6,707	6,024	5,697	5,092	5,330	4,769	4,529	4,633	5,380
Average cows per labour unit .	.	22·67	21·58	19·95	19·91	20·83	20·27	22·07	24·36	25·50	25·80	23·43	20·47	19·85	19·65	21·52	19·90	18·90	21·18
Average acres per male hand ..	acre	75·69	69·29	55·18	61·49	64·37	50·46	56·17	54·88	57·85	61·63	56·16	62·50	61·06	55·48	72·72	48·84	64·85	60·16
Average area per farm	acre	148·36	141·25	122·32	128·41	134·06	99·23	120·37	132·77	163·02	141·76	126·35	137·36	104·45	104·12	157·98	89·81	114·44	124·09
Average cows per farm ..	..	52·60	57·27	58·20	52·71	55·15	47·97	63·57	81·71	83·45	79·13	68·99	59·74	44·39	51·42	60·86	43·65	48·91	57·52
Average butterfat per farm ..	lb.	11,116	12,773	13,124	12,637	12,465	13,048	16,916	22,028	19,316	20,569	18,155	16,628	11,391	13,947	13,484	9,934	11,991	14,610
Average breeding-sows per farm	..	2·36	3·46	3·27	3·94	3·31	4·27	4·55	5·19	7·00	5·50	5·01	3·15	3·50	4·63	3·90	4·94	3·38	4·05
Average laying birds per farm .	..	14·48	11·35	18·80	12·32	14·26	18·97	15·31	10·65	39·36	17·97	17·46	12·12	15·47	15·97	14·72	22·81	10·29	15·33
Average working-horses per farm	..	2·76	2·35	2·47	2·03	2·37	2·57	3·14	3·03	3·27	3·53	3·09	2·70	1·97	2·19	3·31	2·61	2·18	2·61
Average male workers per farm ..	..	1·96	2·04	2·22	2·09	2·08	1·97	2·14	2·42	2·82	2·30	2·25	2·20	1·71	1·88	2·17	1·84	1·77	2·06
Average female workers per farm	..	0·36	0·61	0·70	0·56	0·57	0·40	0·74	0·93	0·45	0·77	0·69	0·72	0·53	0·74	0·66	0·35	0·82	0·65
Average total labour per farm ..	.	2·32	2·65	2·92	2·65	2·65	2·37	2·88	3·35	3·27	3·07	2·94	2·92	2·24	2·62	2·83	2·19	2·59	2·71
Average breeding-sows per 100 cows	..	4·49	6·04	5·61	7·48	6·01	8·90	7·15	6·36	8·39	6·95	7·27	5·27	7·88	9·00	6·40	11·31	6·92	7·04
Average laying-birds per 100 cows		27·53	19·81	32·30	23·38	25·86	39·54	24·08	13·03	47·17	22·70	25·31	20·28	34·85	31·06	24·19	52·25	21·05	26·66
Average working-horses per 100 cows	..	5·25	4·10	4·24	3·85	4·30	5·35	4·94	3·71	3·92	4·47	4·48	4·52	4·45	4·26	5·44	5·99	4·45	4·54
Average male workers per 100 cows		3·73	3·56	3·81	3·96	3·78	4·10	3·37	2·96	3·38	2·91	3·26	3·68	3·85	3·65	3·57	4·21	3·61	3·59
Average female workers per 100 cows	..	0·68	1·07	1·20	1·06	1·02	0·83	1·16	1·15	0·54	0·97	1·01	1·21	1·19	1·44	1·08	0·81	1·68	1·13
Average total labour per 100 cows		4·41	4·63	5·01	5·02	4·80	4·93	4·53	4·11	3·92	3·88	4·27	4·89	5·04	5·09	4·65	5·02	5·29	4·72
Average capital value of implements per farm	£	95	157	136	118	127	139	163	169	238	165	166	211	150	152	166	100	156	157
Average capital value of farm buildings per farm	£	207	247	213	172	207	202	216	250	323	267	239	214	162	209	170	186	241	213
Average capital value of milking-plant per farm	£	225	205	192	226	212	188	195	190	198	215	197	180	189	178	215	188	204	195
Average capital value of implements per cow	£	1·807	2·744	2·342	2·247	2·299	2·891	2·573	2·065	2·852	2·089	2·399	3·523	3·369	2·966	2·724	2·285	3·181	2·735
Average capital value of farm buildings per cow	£	3·938	4·317	3·648	3·262	3·756	4·211	3·397	3·063	3·866	3·374	3·468	3·577	3·660	4·060	2·797	4·263	4·921	3·697
Average capital value of milking-plant per cow	£	4·266	3·571	3·304	4·282	3·842	3·921	3·066	2·329	2·380	2·711	2·854	3·018	4·252	3·456	3·527	4·304	4·181	3·394
Average Government capital value of land and improvements per farm	£	2,385	3,072	3,092	2,647	2,802	2,912	3,459	3,674	2,913	4,553	3,578	3,821	3,404	3,749	1,797	2,967	3,062	3,304
Average Government capital value of land and improvements per cow	£	45·35	53·65	53·13	50·22	50·81	60·70	54·41	44·97	34·91	57·51	51·86	63·95	76·68	72·91	29·53	67·99	62·61	57·44
Average Government capital value of land and improvements per acre	£	16·08	21·75	25·28	20·61	20·90	29·34	28·74	27·67	17·87	32·12	28·31	27·82	32·59	36·01	11·38	33·04	26·76	26·63
Average per cent. milking-plant repairs*	%	3·05	2·89	3·09	3·38	3·13	3·66	4·59	6·33	6·35	4·79	4·95	4·44	3·20	4·01	3·13	3·50	2·85	3·91
Average per cent. implement repairs*	%	5·15	3·44	3·31	3·49	3·70	3·09	3·81	4·54	5·76	5·34	4·37	3·85	3·18	4·78	4·89	4·28	4·13	4·13

* Per cent. repairs to capital value.

Cost Standards.

It is apparent that a reasonable production standard cannot be maintained unless money is spent on the upkeep of farms and herds and farm operators or owners are in receipt of at least a sustenance allowance for living purposes. Therefore these two contingencies must be provided for before any amount is made available to meet interest on capital employed. If they are not safeguarded first the potential production of farm units will be reduced or may disappear entirely. What is a reasonable allowance for working-expenses and for the reward of labour?

Working-expenses.

In this discussion working-expenses cover all items of cost other than labour reward of the owner or of permanent employees, and interest on owner's or borrowed capital. This broad allocation of working-expenses can be broken into subsections—namely, main working-costs, depreciation of plant, &c., sundry overhead expenses, and purchased feedstuffs. Working-expenses will be considered in these subsections, both on the basis of per cow and per pound of butterfat.

Main Working-costs.

This subsection includes costs of cultivation, fertilizers, casual labour, repairs to plant and machinery, power, materials, and sundry items. The district averages for this section range from approximately £2 4s. per cow, or 2d. per pound of butterfat, to £3 per cow, or slightly above 3d. per pound of butterfat. The average cost over the whole 550 farms is £2 12s. per cow, or 2½d. per pound of butterfat. The cost of fertilizers is the most important of this group, ranging as it does from about 3s. 6d. to £1 8s. 6d. per cow, with an average of over 19s. On a per pound of butterfat basis, fertilizers cost from 0·3d. to 1·5d., with an average of 0·9d. The cost of power is next in importance. Although the range of variation in costs between districts is slight, it averages about 8s. 6d. per cow, or 0·4d. per pound of butterfat. Of the average cost of £2 12s. per cow accounted for by this group of items, fertilizers represent 36·75 per cent. and power 16·5 per cent. These main working-costs amount on the average to 60·41 per cent. of the total working-expenses of the 550 farms.

Depreciation of Plant, etc.

When considering his working-costs the average farmer neglects to allow for the depreciation of implements, plant, and buildings. Even where correct accounts are kept and depreciation allowed for the money represented is not usually set aside for replacements, but is used in current upkeep or for personal expenditure. The fact remains that it should be allowed for, and, in the case of the farms under discussion, it amounted to 13s. 6d. per cow on the average, or approximately 0·64d. per pound of butterfat, or 15·61 per cent. of the total working-expenses.

Sundry Overhead Expenses.

This subsection covers rates and taxes and sundry items such as telephone, subscriptions, herd-testing, motor registrations, &c. Rates

are an extremely variable cost, ranging from slightly over 3s. 6d. per cow, or 0·2d. per pound of butterfat, to almost 14s. 6d. per cow, or 0·76d. pence per pound of butterfat, according to the incidence of rates in the various districts. The average rate cost per cow over the whole group is 8s. 9d., or 0·42d. per pound of butterfat. The average cost for the whole group of items under sundry overhead expenses is 15s. 6d. per cow, or 0·735d. per pound of fat, and accounts for 17·97 per cent. of the total working-expenses.

STOCK-FEED PURCHASED.

A certain amount of stock-feed is purchased on all dairy-farms, particularly for pigs and calves and for poultry. This item has an average cost of 5s. 3d. per cow over the 550 farms, or 0·246d. per pound of butterfat, and accounts for 6·01 per cent. of the total working-expenses.

When all costs under the heading of "Working-expenses" are aggregated, it is found that the average costs for the various districts have a range of variation between districts of over £1 per cow, or from £3 16s. 3d. to £4 19s. 6d., with an average overall of £4 6s. 6d. On a per pound of butterfat basis, the variation between district averages is from 3·6d. to 4·7d. per pound, with an average overall of 4·1d. It can therefore be accepted that on well-managed farms producing 120 lb. of butterfat per acre the costs of production as enumerated under the foregoing headings is at least 4d. per pound of butterfat produced. We can now proceed to a discussion of the labour-reward position

Labour Reward.

The cost of casual farm labour has been included in working-expenses, and we are now concerned only with the owner's or permanent labourer's reward. The question immediately arises as to the adequacy of any labour reward which can reasonably be allocated. The number of labour units permanently engaged on a farm must determine the minimum reward required for living purposes, but if labour is employed extravagantly the resultant labour cost per pound of butterfat will be greater than can be paid. It might reasonably be argued that the number of cows milked per labour unit should determine the level of labour reward. In actual practice farmers employ a minimum of paid labour and live on the smallest possible amount in an endeavour to meet their liabilities, but for the purpose of discussion it is necessary to assume a labour-reward standard which may be varied to suit requirements. Therefore a labour reward of £100 per annum per unit of male labour engaged on farms has been taken. This is probably more than the cost in wages and keep of the average employee, but where the owner only is concerned it may be inadequate to provide for family necessities. It is obvious that with a fixed labour-unit charge labour costs per pound of butterfat will vary according to the number of cows milked per labour unit and the production level of herds. In other words, a measure of management and labour efficiency is obtained. The effect, based on district averages, is to give a per pound cost range between 2·6d. and 4·4d., with a general average of 3·4d. per pound, which illustrates the scope for improvement in stock and in the

exploitation of labour. It can be accepted, however, that under the conditions prescribed in this analysis a labour cost of 3½d. per pound of butterfat should provide an annual payment of £100 per year per male unit of labour, if the size of the farm and herd is such that labour can be employed with a fair degree of efficiency.

We therefore arrive at the position where we can say that working-expenses and labour absorb 7½d. per pound of butterfat on well-managed farms producing 120 lb. of butterfat per acre. We must now consider the capital and interest position.

Interest on Capital.

There is no recent information available to show the actual interest burden of dairy-farmers. It is known that full liabilities cannot be met in a great percentage of cases. The Government valuation of these 550 farms is known, however, as is also the approximate replacement value of stock and plant. As Government valuation forms the basis for rates assessment, and to some degree for mortgages, a combination of valuation of land and improvements and of values of stock and plant can be accepted as a reasonable basis on which to discuss capitalization. It is well known that the purchase price paid for many farms has been well above Government valuation, which is in many cases exceeded by mortgages. The district group averages for Government valuation varies between £16 and £36 per acre, with an overall average of £26 12s., whilst stock and plant varies between £6 12s. and £9 per acre, giving a total capitalization basis varying between £22 and £44 per acre, or a general average of £34 This amount equals an annual charge of £1 14s. per acre on a 5 per cent. interest basis, or 3·4d per pound of butterfat if 120 lb. per acre is produced. This added to working-expenses and labour reward would bring the total cost per pound of butterfat to 10·9d If 20 per cent. of this assumed capitalization is farmers' equity, then the cost per pound would be reduced to 10·22d. at 5 per cent. If interest were reduced 1 per cent. the cost per pound of full capitalization would be 10·2d., or with 20 per cent. equity, 9·66d. per pound. What amount of interest can efficient farmers pay on reasonably good farms of economic size? Let us take the standard of 120 lb. of fat per acre and accept that 7½d. is a reasonable cost to cover working-expenses and labour. The prices realized to date for this season's dairy-produce suggest that an average pay-out of 8½d. in New Zealand currency may be expected. In addition to the return on butterfat, an amount equal on the average to 1d. per pound of butterfat may be obtained from pig products. The meat-marketing negotiations taking place in Great Britain indicate that bobby veal and boner cows cannot be relied upon to materially augment incomes from dairy-farms. The average gross returns per pound of butterfat produced should therefore approximate 9½d., or 2d. per pound above the costs of working and of labour, when the latter is assessed on the basis of £100 per annum labour reward per unit of male labour. A surplus of 2d per pound devoted to interest would give £1 per acre on farms producing 120 lb. per acre. This amount when capitalized equals £20 per acre at 5 per cent., £25 per acre at 4 per cent., and £33 8s. (approximately) per acre at 3 per cent.

The Influence of Per Acre Production on Costs.

The discussion up to this stage has been based on district averages and on the average for the 550 farms which form the basis of the analysis. Standards have been set on an assumed "average farm," and this is a common practice when costs of production are under discussion. It must be stressed at this stage that it is impossible to apply such standards to dairy-farms, as no two units are exactly alike in composition and/or management. In the final analysis of the farmers' position, each case must be treated individually to ascertain working-expenses, labour efficiency, and reward, and the surplus available to meet the demands of capital. It is a fact, however, that certain principles apply generally, a knowledge of which enables a more rapid and comprehensive view to be taken. In this respect the influence of the level of production reached per acre is of the greatest importance as it is directly influenced by the inherent quality of the land, the type of stock carried, and the level of efficiency reached in general management. No matter what factors may be affecting production, the level reached has a direct bearing on costs per pound of butterfat and on the income available for distribution.

As indicated previously, the 550 farms under analysis are good farms for the districts concerned, and as a group can be accepted as above the Dominion average in per acre production. Nevertheless there is a wide range of variation within the group. The range of production, and the factors accompanying this spread is shown in Table No. 2.

Table No. 2.—Range of Butterfat Production per Acre

Butterfat per Acre Range. (Pounds.)	Average Butterfat Per Acre (Pounds.)	Cows milked per 100 Acres. (Number.)	Average Butterfat per Cow (Pounds.)	Average Area of Farms (Acres.)	Farms in each Group (Number.)
Under 75	56·826	29·2	195	191·7	68
75–99·99	85·680	36·2	238	143·5	87
100–124·99	112·460	45·9	245	137·1	108
125–149·99	137·841	51·9	264	116·5	105
150–174·99	160·788	59·2	272	91·3	84
175–199·99	186·774	66·2	282	82·1	53
200–224·99	210·406	71·0	296	83·2	29
225–249·99	238·303	79·0	302	75·4	10
250 and over ..	281·535	86·9	324	85·6	6

The position indicated in this table shows the difficulty encountered in attempting to standardize farm data, particularly when it is remembered that the farms within these narrow production groups will show a degree of variation. It does, however, serve to show the factors accompanying or influencing production, and the rapidity with which the frequency of farms drop when the average production level is passed. This breakup into definite production groups can also be used to show the effect of production on costs and on the interest surplus. To illustrate the point, working-expenses are taken as the same group

of costs previously discussed, the same labour reward is used, and 9½d. per pound of butterfat is taken as the return from all sources. The results are shown in Table No. 3.

Table No. 3.—Costs and Interest Surplus per Pound of Butterfat according to Per Acre Butterfat Production Level.

Butterfat per Acre Range. (Pounds.)	Working-expenses per Pound of Butterfat. (Pence.)	Labour Cost per Pound of Butterfat. (Pence.)	Total Costs per Pound of Butterfat. (Pence.)	Interest Surplus per Acre. (Shillings.)
Under 75	5·014	4·439	9·453	..
75–99·99	4·335	3·841	8·176	9·5
100–124·99	4·171	3·516	7·687	17·0
125–149·99	4·058	3·147	7·205	26·3
150–174·99	3·806	3·164	6·970	33·9
175–199·99	3·813	3·041	6·854	41·2
200–224·99	3·640	2·885	6·525	52·2
225–249·99	3·438	2·671	6·109	67·3
250 and over	3·498	2·490	5·988	82·4

It will be seen that the interest surplus per acre increases rapidly under the influence of lowering costs per pound of butterfat, and an increasing production per acre. Whereas in the lowest production group costs equal income, the surplus rapidly rises until it reaches over £4 per acre, even under conditions of low prices. This increasing surplus is offset to some extent by a corresponding rise in Government valuation and in the replacement value of stock and plant. In this connection it is of interest to note that on these farms valuation shows a definite gradation upwards as production increases, but the rate of increase in valuation does not keep pace with the interest surplus. In other words, the Government valuation very justly does not fully capitalize potential production and efficiency in management. In Table 4 interest surplus is arranged against total capitalization (Government valuation plus value of stock and plant) and the capacity of the surplus to meet interest is shown at varying rates.

Table No. 4.—Interest Surplus according to Butterfat per Acre Range.

Butterfat per Acre Range. (Pounds.)	Interest Surplus per Acre. (Shillings.)	Total Capitalization per Acre. (£)	Interest Surplus Capitalized at— 5%. (£)	4%. (£)	3%. (£)	Value of Stock and Plant per Acre. (£)
Under 75 ..	..	18·5	..	..	..	4·0
75–99·99 ..	9·5	27·7	9·5	11·9	15·8	5·9
100–124·99 ..	17·0	32·0	17·0	21·2	28·3	7·3
125–149·99 ..	26·3	38·0	26·3	32·9	43·8	8·4
150–174·99 ..	33·9	44·7	33·9	42·4	56·5	9·5
175–199·99 ..	41·2	52·1	41·2	51·5	68·7	10·9
200–224·99 ..	52·2	57·1	52·2	65·2	87·0	11·4
225–249·99 ..	67·3	58·0	67·3	84·1	112·2	12·4
250 and over ..	82·4	60·0	82·4	103·0	137·3	13·2

The facts disclosed in this table are really a summary of the position of the good dairying units of the industry to-day. Although total capitalization may not be an absolute measure of mortgages, there will be a close relationship between the two items. The capitalization of

interest surplus at varying rates shows that even at 3 per cent. it is not until we reach the 125 lb. to 150 lb. per acre group that the capital represented coincides with the total of Government valuation plus value of stock and plant. When studying the amount of capital per acre on which the varying interest-rates can be paid the value of stock and plant as shown in the table must be deducted to get the value of land and improvements represented, and it will be noted that the groups up to 100 lb. per acre provide a negligible surplus for interest on land mortgages.

The position disclosed can now be summarized—

(1) The group of farms forming the basis of this analysis are above the average for New Zealand in that the average production per acre is approximately 120 lb., whereas the average over all land devoted to dairying is probably about 90 lb. Therefore, if all farms could be considered, the percentage grouping in the lower-production classes would be greater than is indicated.

(2) The farms under consideration are economic units in that the number of cows milked allows of a reasonable utilization of labour. A large percentage of the dairy herds of the Dominion are small, and whereas in the group taken approximately thirty cows are milked per male unit of labour permanently employed there are many thousands of farms on which less than twenty cows are milked per male labour unit. Consequently, the cost of labour per pound of butterfat, even on a bare sustenance basis, is heavier where small herds are milked, and thus the interest surplus is affected. Coincident with high labour costs on such farms it is found that where herds are small, owing to the limited area of the farm, capitalization is heavy. In other words, small well-developed farms have a high capital value and, owing to the limited gross income even at maximum production, there is little or no surplus for interest, after working-expenses are met and the owner and family extract a bare living.

(3) The analysis again proves the constantly reiterated fact that low per acre production is associated with high production costs, and a low-interest-paying capacity. At a given price-level the number of farmers who are able to pay interest and the amount which can be paid depends on the numbers falling within certain production and size groups.

(4) The analysis demonstrates the necessity of considering any farm proposition individually when reviewing the ability of the farmer to meet his liabilities.

(5) The validity of the low interest surplus shown in the analysis depends on the degree of accuracy or reasonableness of the assumptions made. The costs covered under working-expenses cannot be disputed. If these are not maintained at a reasonable level the security represented in farms is undermined to the ultimate detriment of all concerned. It may be possible for dairymen to carry on with a lesser labour reward than the amount used in this discussion. If it is possible and the position is so controlled that a lesser amount is allowed, the interest surplus would be improved accordingly. The only other factor concerned is gross income per pound of butterfat sold. The final result for the current season can only be estimated at this juncture, but the basis for forming an estimate is available, and unless unforeseen circumstances arise there is no reason to be more optimistic than is denoted by the estimate of a final gross income of 9½d. per pound for butterfat, which includes average returns for pigs.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

RECORD OF ACTIVITIES IN WELLINGTON DISTRICT, 1933-34 SEASON.

A. J. GALPIN, Fields Division, Palmerston North.

THE difficulties of the times have not passed this movement by, yet the season under review can again be recorded as another successful event in the history of the competitions, this being demonstrated by the increase in the number of entries received.

That the movement can still grow despite economic obstacles makes it one that must be regarded as successfully filling a place in the education and home life of the younger generation.

The following tables show the extent of the movement over the last three seasons. It will be noted that while the root-growing competitions have shown a small decrease, this has been offset by the expansion of the calf-rearing competition.

The completed entries in the crop competitions were :—

District	Season.		
	1931-32	1932 33	1933-34.
North Taranaki	36	58	84
South Taranaki	217	197	192
Wanganui - Main Trunk ..	148	192	143
Manawatu	241	154	148
Southern Hawke's Bay ..	35	58	37
Wairarapa	28	..	..
Gisborne	..	..	9
Totals	705	659	613

The entries judged in the calf-club competitions were :—

District.	Season.		
	1931-32	1932 33.	1933-34.
North Taranaki	288	309	350
South Taranaki	524	418	449
Wanganui – Main Trunk ..	190	192	190
Manawatu	227	231	227
Horowhenua	59	114	107
Southern Hawke's Bay ..	92	140	150
Wairarapa	101	203	251
Gisborne	..	..	36
Totals	1,481	1,607	1,760

Calf Clubs.

The activities of the calf-club movement have been established in Taranaki for a longer period than in any other part of the Wellington district at least, if not of the Dominion. That time has brought no lessening in the enthusiasm of earlier years can be gauged by a comparison of the entries brought forward for judging over the past nine seasons :—

Season.	North Taranaki.	South Taranaki
1925–26	55	155
1926–27	115	242
1927–28	154	277
1928–29	215	311
1929–30	294	360
1930–31	250	403
1931–32	269	385
1932–33	306	418
1933–34	350	449

It might perhaps be assumed that the explanation of this steady advance of the movement lies in the fact that Taranaki is given mainly to the dairying industry. While perhaps this is partly correct, a perusal of the preceding table showing the growth of the movement in the Wellington district over the previous three seasons appears to indicate that, even though comparatively new in the remaining districts, the calf-club work is gaining general support. From the above two facts are apparent : the steady increase in the number of participants in the competitions is a proof that the principles of the movement are ones that interest and appeal to those eligible to compete, and the sustained growth is a practical demonstration of the interest and support given by parents and all interested in the welfare of the farming community.

While these two points are definite proof of general popularity, the question arises whether there is any definite indication that beneficial results are being gained through these competitions. The excellent score-cards handed in by many of the senior competitors in the judging competitions are in themselves sufficient evidence that the competitions are a successful medium of inculcating the knowledge of the essential points of good stock, which fact can have only one result —better stock and better farmers.

Crop Competitions.

North Taranaki.

As in previous years competitors were allowed the choice of a mangel carrot, or swede crop. To add further interest to the work, Prizewinner Yellow Globe mangels and Matchless White carrots were grown experimentally to compare the relative yields of 22 in. and 18 in. rows. In the case of swedes the comparison was between Superlative and disease-resisting Herning Swede. This trial is to be continued for a further season to verify the results obtained.

The entries in the competitions numbered 184, but out of this number only 84 plots reached the final judging. This heavy defection was caused principally by the incidence of heart rot in many of the mangel crops and by generally disappointing results in the swede crop—the roots made little development, the growth going into leafage and long neck.

The Trimble Shield for best club work was won by the Tikorangi School. Graham Caldwell, of Warea School, with a yield of 68 tons 10 cwt. per acre of Matchless White carrots, was not only the winner of this competition, but also next in merit to the winner of the Stuart Wilson Cup awarded for the Dominion champion field crop. The winning crop in the mangel competitions was grown by Walter Baker, Pukearuhe, the variety being Prizewinner Yellow Globe, with a yield of 142 tons 10 cwt per acre.

SOUTH TARANAKI.

The fact that supplies of seed and manures could not be made a charge against the association caused considerable delay in deciding whether it was possible to run the competition, and it is pleasing to note that when this difficulty was given general publicity the following merchants showed in a very practical manner their interest and desire to co-operate in the continuance of the work by donating free of charge the necessary seed and fertilizer: Messrs. Hodder and Tolley, Cathie Dempster, Carter's Ltd., Webster's Ltd., Newton King, Ltd., New Zealand Loan and Mercantile, Farmers' Co-operative Society.

In the mangel-growing competition thirty-six plots were brought forward to the final judging with an average yield of 72 tons 3 cwt. per acre, which compares favourably with the record average of 73 tons 18 cwt. established in the previous season (1932–33). The winning crop was grown by Eva Gulliver, Whakamara, with a yield of 136 tons 17 cwt. per acre.

The carrot-growing competition attracted seventy entries, of which forty-eight reached the final judging. Opportunity was taken of conducting a variety trial with Webster's Matchless White and Carter's Orange Giant. Both varieties did well, with Matchless White giving the greater yield on almost every plot. The average yields were as follows: Matchless White, 51 tons 8 cwt per acre; Carter's Orange Giant, 45 tons 9 cwt. per acre. The outstanding feature was the crop produced by Jean Williams, Meremere, which represented a yield of 100 tons 19 cwt. per acre.

WANGANUI.

As in previous years mangels, carrots, and swedes were grown, and it is noticeable that, parallel with the growth of the calf-rearing movement, there is a tendency for entries to fall away in these competitions. This reduction is perhaps due to the root-growing competitions losing some of their novelty, as they have now been in operation for the past fourteen years, whereas the calf clubs are a comparatively new and different sphere of activity.

Again this season all plots were located in the school grounds, thus placing all entrants on a uniform basis and successfully overcoming the difficulties arising from soil variation. The fact that 97 per cent. of the original entries reached the final judging is no doubt due to the greater measure of supervision that is possible under this method.

The extent to which the additional supervision has been reflected in the work of the competitors can be estimated by the fact that the Henry Lane Challenge Shield, awarded to the school gaining the highest aggregate in this and the Taranaki district, after remaining for a very long period in the Taranaki area, has now been won by the Alton School.

To all concerned in the administration of the movement it must be a source of satisfaction that their efforts have met with such a practical response from the competitors.

The number of plots entered was 147. The number of plots completed was 143.

The highest yield in tons per acre was: Mangels, 107; carrots, 69; swedes, 79.

The average yield in tons per acre was: Mangels, 43; carrots, 40; swedes, 47.

MANAWATU.

As in the previous year, the competition was confined to mangel production with two types being used for comparison purposes—namely, Red Intermediate and Prizewinner Yellow Globe—201 entries were received and 148 reached judging with an average yield of 59 tons 14 cwt. per acre, which has only once been exceeded.

The crop producing the heaviest yield was grown by E. Cask, Bainesse, and was equivalent to 115 tons 17 cwt. an acre. A feature of this crop was the number of solid roots it is possible to produce provided liberal initial seeding with a good strike, coupled with subsequent careful thinning is adopted On the one chain selected for weighing, as being representative of the whole plot, 160 roots were counted, with an average weight of approximately 5 lb. a root.

SOUTHERN HAWKE'S BAY.

In this locality seasonal conditions were not favourable for mangel-growing, and this is reflected in the comparatively large number of the original entrants whose plots did not reach finality, the entries received being fifty-seven and the completed plots numbering thirty-seven. Three varieties grown were Red Intermediate, Prizewinner Yellow Globe, and Jersey Queen, which produced average yields of 66 tons 7 cwt., 63 tons 3 cwt., and 51 tons 17 cwt. per acre respectively. The winning crop was grown by Rodney Court, Woodlands Road, with an acre yield of 103 tons 10 cwt , the variety being Prizewinner Yellow Globe.

GISBORNE.

At present the competitions in this district are confined to the Tolaga Bay district, and, until the past season, have been controlled by officers of the District High School. Early last season representations were made for official recognition by this Department, and after certain negotiations, from which arose a general understanding of the rules and aims of the movement, the requested support was given.

On account of the initial arrangements not being finalized earlier in the year, the support of the Department of Agriculture was confined

to supplying the necessary stationery and some short lectures, the local officer being unable, on account of certification duties, to attend at the the final judgings.

The work of the club has been carried on under three main divisions: (*a*) Calf and lamb rearing competitions; (*b*) crop-growing competitions; (*c*) farm-instruction work for pupils of the secondary department of the district high school.

Calf and Lamb Rearing.—A field day was held at the school on 15th December, 1933. when thirty-six calves and twelve lambs were judged. For the initial effort this was very satisfactory. The high standard of the animals presented was remarked upon the by calf judge, Mr. Cooper, who said that he had never seen a better class of calves throughout New Zealand. The Poverty Bay A. and P. Association has inaugurated a class for yearling heifers shown in school parades, and Mr. Chamberlain, Secretary to this body, expressed the hope that the 1933 competitors from Tolaga Bay would be represented in this event in 1934

Crop Competitions.—The crops were inspected by Mr. R. G. Lockhart, Instructor in Agriculture, Hawke's Bay Education Board, in February, and marked for choice of site, cultivation, and thinning. In his report to the Committee Mr. Lockhart remarked on the disappointing number of pupils who did not complete the course, the percentage being less than 25 per cent., and on the pleasing standard of work shown by those pupils who did.

The weights of the winning crops in both divisions were satisfactory, that of the leading crop of carrots being 79 tons 4 cwt. per acre and of mangels 93 tons 18 cwt.

In connection with both live-stock and crop competitions, thanks are due to the dairy company and a number of supporters who donated prizes and to the commercial firms who donated seeds and fertilizer.

Farm-instruction Work.—Much interesting and valuable work has been accomplished in farm instruction. A number of visits were paid to farms where work of a special nature was in progress, while a number of local farmers and Government officials visited the school and gave lectures or demonstrations. There were at least four visits or lectures per term.

MEAT-FREEZING INDUSTRY.

The quantities and values of the principal products for the years 1931–32, 1932–33, and 1933–34 are presented in the following table:—

Year.	Mutton.	Lamb.	Beef.	Preserved Meats.
		Quantities.		
	Carcasses.	Carcasses.	Cwt.	Cwt.
1931–32	2,802,818	8,395,661	545,957	34,233
1932–33	2,660,585	9,235,608	782,082	51,531
1933–34	1,995,435	8,582,957	981,757	46,324
		Value.		
	£	£	£	£
1931–32	1,574,798	5,775,708	546,252	103,100
1932–33	1,486,741	6,163,241	846,842	137,309
1933–34	1,461,056	7,095,262	924,758	127,658

—*Abstract of Statistics.*

HYDATID DISEASE.*

J. E. McIlwaine, Acting District Superintendent, Live-stock Division, Wellington.

The subject of hydatid disease in animals is a most important one for farmers and for all other rural workers in New Zealand. The need for information in regard to this disease in animals is important not only from a veterinary viewpoint, but more especially from the viewpoint that human beings are liable to become infected from a similar source to that of our domestic animals. It has been shown by Sir Louis Barnett, in the *New Zealand Medical Journal*, August, 1934, that hydatid disease in the human subject is increasing somewhat in New Zealand. In the *Journal* mentioned it is estimated that from a hundred to a hundred and fifty cases are occurring every year, with a mortality of about 15 per cent. Although only 15 per cent. of cases prove fatal, a number of other cases tend to recur from time to time and call for hospital and surgical treatment.

It is mainly because this disease in man and animals can be prevented that rural workers in New Zealand are asked to co-operate in the reduction of the number of the cases. The incidence of the disease can be reduced, provided an effort is made to do so. A few years ago Otago had the unenviable position of having the highest number of cases of hydatid disease in the human subject, whereas in more recent years that position has now been taken by Canterbury. The success in the reduction of the number of cases in Otago can be credited to those men in Dunedin and surrounding districts who have spent a good deal of time in teaching the people about this disease. New Zealand and Australia appear to be the main countries where this disease is so prevalent as to warrant the steps being taken to reduce its incidence. This feature of these two countries is apparently due to the extensive pastoral interests of both countries.

Hydatid disease in animals and man occurs as a result of the development in the body of what are termed hydatid cysts. These are bladder-like bodies which constitute the first stage in the development from the egg of a particular variety of tapeworm (technically known as *Taenia echinococcus*) which commonly infests the bowels of dogs. Among our domestic animals, cattle, sheep, and pigs commonly act as the intermediate hosts of this parasite, although man and even rabbits are on occasion also hosts.

What is a hydatid cyst? A hydatid cyst resembles in appearance a bladder of varying size distended with a watery-looking fluid. The cysts are more or less regularly rounded in shape and sometimes are present in large numbers in the one animal or person. The wall of the cyst is thin and if the cyst is suspended the wall is translucent. The cyst is often distended with fluid which is easily evacuated by puncture of the cyst wall. The cysts are most commonly found in the lungs and liver, but any organ of the body as well as other of the body tissues may be affected by them. The seriousness of the disease in the human subject is due to the fact that vital organs such as the lungs may be affected when surgical operations for their removal often prove very difficult. In the course of meat inspection which is carried out at the freezing-works and abattoirs throughout the Dominion, the cysts are often seen affecting the lungs and livers of cattle, sheep,

* Portion of a lecturette broadcast from Station 2YA.

and pigs. Cysts have even been seen in the muscular wall of the heart itself. In a few cases the lungs of the ox have been so completely affected with the cysts as to give the impression that the animal during life was affected with pneumonia or tuberculosis of the lungs. Any rural worker who is not familiar with the appearance of the cysts may have it demonstrated to him at almost any freezing-works during the busy killing season.

The presence of these cysts in the internal organs or tissues of cattle, sheep, and pigs does not constitute any danger to the health of human beings consuming their flesh. The connecting-link so far as the human being is concerned is between the infected dog and the human being. This will be made clear as we proceed with the life-history of the parasite which is responsible for the development of the cysts. By far the greater majority of food-animals in whose bodies hydatid cysts are present do not appear to suffer in health in consequence. Their bodies remain well nourished, and, so far as their flesh is concerned, they are perfectly healthy. The affected organs are, however, dealt with in the course of meat inspection for obvious reasons. On rare occasions an organ may be so grossly affected as to interfere with its natural function, when the affected animal may become weak and emaciated In such cases, however, the inferior and innutritious nature of the flesh renders it unfit for human consumption, and the carcass of such an animal is dealt with accordingly. The real danger of the cysts becomes evident when these are eaten by a dog. The lining membrane of the cyst contains a number of smaller bladders, which in turn contain a number of small bodies. These in reality are the immature heads of the tapeworms. Each small body is capable of developing into the mature tapeworm when the uncooked cysts are eaten by the dog. The danger of propagating the tapeworms in the dogs lies in the feeding of dogs on uncooked offal containing hydatid cysts. Old dogs are more likely to harbour the parasites than younger dogs. Farmers' dogs which are fed on uncooked offal, or drovers' dogs which are not chained up on arrival at the freezing-works or abattoir, are liable to be more seriously affected than town dogs. The subject of hydatid disease is therefore of more direct interest to the rural worker amongst stock.

The particular tapeworm which is directly responsible for the dissemination of hydatid disease represents the smallest known species of parasite of its class. It is about ¼ in. in length when fully mature and is composed of three or four segments. The head becomes attached to the bowel wall of the dog, and the segments containing the ripe eggs are liberated and passed in the excrement of the dog. The mature detached segment, packed with eggs, may be deposited by the dog on pasture land where animals are grazing or near the edges of streams and water-courses, when the water-supply is contaminated. The contamination of green vegetables may be similarly brought about. Whenever cattle, sheep, or pigs or man swallow the eggs, either by ingestion of contaminated food or water, they run the risk of becoming subjects of hydatid disease. The eggs when swallowed and acted upon by the digestive juices liberate the immature worm. This bores its way through the bowel wall and is carried by the blood or lymph stream to the lungs or liver and there develops into the hydatid cyst. Infection may also directly occur from the dog owing to eggs being carried on the dog's coat, the dogs being fondled by their owners and their owners' children. The eggs are so small as not to be easily seen by the naked eye.

From what has already been said it will be apparent that precautions are more important so far as the human subject is concerned than is the case in the domestic animals. The important point in the prevention of the disease is in breaking the chain in the life-cycle of the tape-worm of the dog. This can be brought about in several ways. Firstly, there is the eradication of the tape-worms from the dogs by the regular dosing of dogs with suitable medicine. This can be effected by dosing the dogs every six months. The tape-worms can be eradicated by dosing the dogs with a preparation known as Tenaline. Freshly ground areca nut is often used in doses of 2 grains per pound body-weight of the dog to be treated. It is important to have the areca nut freshly ground. When this powder is given it is sometimes incorporated in butter, and the dog swallows it without the necessity of much dosing.

Arecoline hydrobromide, which contains the active principle of areca nut, is also used as an agent for the eradication of tape-worms from the dog. To eradicate the tape-worm it is necessary first to fast the dog for twenty-four hours. After treatment it is advisable to tie the dog up and treat all the contaminated excrement by burning, so as to destroy the worms and eggs.

Another break in the life-cycle of the parasite, the tape-worm, may be brought about by seeing that dogs do not feed on raw offal. If this rule were strictly observed on farms, sheep stations, in the vicinity of country slaughterhouses, abattoirs, and freezing-works, the dogs could not become infested with the tape-worm. If such offal is required for feeding dogs, it can be rendered harmless by boiling before use. The flesh of the animal is very rarely affected, but the offal constitutes a serious source of danger in this respect.

Still another break in the life-cycle of the parasite may be brought about by ensuring that the eggs passed by the dog are not consumed in the food or water used by the human subject. This is difficult to ensure in the case of herbivorous animals, but with care should be obtained in the case of the human subject. The fondling of dogs by human beings is not without risk, as the dog's coat is liable to contain eggs of the parasite. Infection from hand to mouth is obviously easy, and in children dirty hands may thus convey hydatid disease. The habit dogs have of licking their human companions' hands, face, or food utensils is, of course, dangerous. Dogs should not be allowed to eat off or lick plates or other dishes which are subsequently utilized for table or domestic purposes. It is possible for human beings to become infected by eating uncooked vegetables such as watercress, lettuce, celery, &c., which have been grown in an area exposed to canine contamination. Water from creeks or streams which is liable to be contaminated by dogs should not be used for drinking purposes unless previously boiled or efficiently filtered.

Flies may act as carriers, and food should always be protected from flies for this and other reasons.

It is to be remembered that a united effort on the part of dog-owners to reduce the incidence of hydatid disease in man will also considerably reduce it in animals, with, in consequence, less risk of the treated dog becoming reinfested. With this reduced incidence in stock the farmer will obtain a better return from his stock from the freezing companies. If the precautions which have been mentioned are taken over a number of years the number of cases of this disease in man could be materially reduced.

FARMERS' FIELD COMPETITIONS.

SUMMARY OF DOMINION RESULTS, SEASON 1933-34.

R. P. CONNELL, Fields Division, Department of Agriculture, Palmerston North.

THE number of entries judged in the Farmers' Field Competitions for the season 1933-34 exceeded by 62 the number for the previous season and thereby broke the previous record number of entries. The entries judged in the various districts for the past four seasons were :—

—	1930-31.	1931-32	1932-33	1933-34
Auckland	*	134	165	128
Wellington	560	807	875	966
Canterbury	*	*	46	64
Otago	*	*	30	20
	560	941	1,116	1,178

* Figures not available

That the competitions continue to be given increasing support is gratifying because of the proven value of the information which well supported competitions are capable of yielding Competitions normally enable instructive comparisons to be made between the results obtained from different practices in respect to such matters as manuring, cultivation, seed, varieties, and harvesting—matters in which there is much variation in the field The reliability of the conclusions from such comparisons is governed to a large extent by the number of crops which are considered, and in some instances, because of the paucity of entrants, the full potential educational value of the competitions is not realized. Emphasis on the educational as distinct from the competitive side of the movement might assist participating farmers to persuade fellow-farmers to take part in the competitions and thereby increase their value to all concerned

The main features of the competitions are summarized below.

MANGELS.

The number of mangel entries judged increased from 94 in 1932-33 to 118 in 1933-34.

The heaviest crop for the year was a phenomenal one of 170 tons 6 cwt. an acre, which is substantially heavier than any crop previously recorded in competition work. It was grown by Mr. H. T. Paul, Okato, in a holding paddock adjacent to the milking-shed, and hence greatly enriched by animal manure. The area was ploughed in mid-September and then given three double diskings, two harrowings, and a rolling. The variety Prizewinner Yellow Globe was sown on the 1st October

at the rate of 4 lb. an acre in ridges 17 in. apart. Special mangel manure was sown with the seed at the rate of 6 cwt. an acre. The seedlings were hoed twice before thinning and subsequently hand-weeded four times. Factors that contributed to the exceptionally heavy yield were (1) the accumulated animal manure, (2) the thorough preparatory working of the ground, and (3) the thorough management after sowing. In South Taranaki the heaviest crop was that of Mr. A. T. Burke, Lowgarth, which yielded at the rate of 105 tons an acre. In Wanganui district the heaviest crop was grown by Mr. T. Alexander, Maxwell, who obtained a yield of 110 tons 15 cwt. an acre by sowing 5 lb. an acre Prizewinner seed on the 15th October in drills 24 in. apart The land which previously was occupied by swedes was ploughed in September, well cultivated, and drilled with 7 cwt. an acre of a mixture of superphosphate and blood-and-bone.

In Manawatu the heaviest crop, of 107 tons an acre, was grown by Mr. H. Hancock, Awahuri, who sowed 4½ lb. an acre of Red Intermediate on the 28th October in drills 26 in. apart. The land which was rich silt was ploughed in September, well cultivated, and received 3 cwt. an acre of blood-and-bone. Subsequent to sowing the crop was thoroughly cultivated, which contributed to the good yield. In Hawke's Bay the heaviest yield, one of 77 tons 11 cwt. an acre, was grown by Mr. G. Holden, Norsewood, in drills 18 in. apart.

In Pahiatua the winning crop of Mr. J. M Bremner, Ballance, weighed 58 tons 15 cwt. an acre. Prizewinner Yellow Globe seed at the rate of 6 lb an acre was sown on the 13th October, together with 7 cwt an acre of mixed fertilizer on land which was ploughed early in September and subsequently well cultivated both before and after sowing. In Poverty Bay the heaviest crop, of 64 tons 12 cwt., was that of Mr. G. V. Smith.

In Auckland the heaviest crop, that of Mr A. Woolsey, Patumahoe, yielded 40 tons 5 cwt. an acre. It followed swedes The land was ploughed twice before planting, then ploughed at planting-time. The seedlings were transplanted into furrows as the land was ploughed and there was no after cultivation. The variety was Prizewinner Yellow Globe and the crop received 13 cwt. an acre of fertilizer consisting of 5 cwt. superphosphate, 5 cwt Kainit, and 3 cwt. blood-and-bone.

In Canterbury the heaviest crop, of 121 tons an acre, was grown by Mr. A. Stalker, Rangiora, who skim-ploughed the land in May and in July ploughed it deeply with a swamp-plough. Farmyard manure at the rate of from 4 tons to 6 tons an acre was applied before ploughing deeply. It was well cultivated, and sown on the 27th September with 6 lb. an acre of Prizewinner Yellow Globe, together with 2 cwt. an acre of mangel manure.

Again Prizewinner Yellow Globe was prominent throughout in the prize list. In general the management of crops of those competitors who won prizes or secured heavy yields was characterized by—(1) The provision of high fertility either by selecting naturally rich land or by liberally applying fertilizers; (2) thorough cultivation both before and after the sowing of the crop.

SWEDES.

In the swede-growing competitions 172 crops were judged in comparison with 157 entries judged the previous year and 76 a year earlier. The heaviest crop in the competitions, that of Mr. H. E. Nowell, Cardiff, yielded 78 tons 5 cwt. an acre. On the 18th November 16 oz. an acre of Success swede, together with 3 cwt. an acre of special turnip manure was sown on land which was ploughed about the middle of October and subsequently double-disked seven times and harrowed three times. In South Taranaki the heaviest crop, of 74 tons 11 cwt., was grown by Mr. J. Kaiser, Kaponga.

In Manawatu the heaviest crop, of 70 tons 16 cwt. an acre, was grown by Mr. H. G. Hare, Arapata, who, on the 23rd November, sowed Masterpiece in 28 in. drills at the rate of 1 lb. an acre with a mixed manure consisting of 3 cwt. superphosphate, 2 cwt. ephos, 1 cwt. blood-and-bone an acre. In Hawke's Bay the winning crop, one of Superlative grown by Mr. G. Holden, Norsewood, yielded 64 tons an acre.

In the Wairarapa competition the winning crop, that of Mr. W. Olsen, Kohinui, was Superlative, sown at the rate of 1 lb. an acre in 28 in. drills, which yielded 78 tons an acre. It received 8 cwt. an acre of a mixture of equal amounts of superphosphate and blood-and-bone. The ground was ploughed out of pasture in early August, subsequently well cultivated, sown in early November, thinned, and twice intertilled in December.

In Auckland the heaviest crop, one of 53 tons an acre, was grown by Mr. K. Wright, Patumahoe, who sowed Superlative in 14 in. drills on the 30th November, together with 3 cwt. an acre of a proprietary turnip manure on land ploughed out of grass in September and subsequently well worked to a fine tilth.

In Canterbury the heaviest crop was one of 65 tons an acre of Superlative grown by Mr. A. Stalker, Rangiora, and in Southland the heaviest crop, of 58 tons 7 cwt., was grown by Mr. A. O. Fleming, Grove Bush, who sowed 11 oz. an acre of two varieties (Masterpiece and Elephant) about the 20th November on land which had been pre-limed and which at sowing received 3 cwt. of a mixture consisting of superphosphate 1 cwt., Island phosphate 1 cwt., carbonate of lime 1 cwt., and blood-and-bone ½ cwt.

The competitions usefully indicate that highly profitable crops of swedes are grown practically throughout the Dominion, and that, while good results are obtained under a wide variation in practice in respect to such matters as the amount of seed and manure, the distances between the drills, and the varieties used, significance must be attached to the frequency with which good yields are associated with thorough preparatory cultivation. Though there are apparently local preferences in respect to varieties, the number of crops considered in several of the districts is not great enough to provide a reliable indication as to whether such preferences are well-founded. A much favoured fertilizer treatment is the use of a dressing of 3 cwt. an acre in which phosphate is dominant.

Soft Turnips.

Only 17 crops of soft turnips were judged in the competitions. The heaviest crop recorded for the year was one of 60 tons 18 cwt., grown by Mr. A. D. Johnson, Okaiawa, Taranaki. In Auckland the crops judged were all in the Rotorua district. The heaviest, that of Mr. A. J. Gillanders, Reporoa, yielded 30 tons 16 cwt. an acre. In all Rotorua cases too much seed was sown, resulting in excessive growth of tops and crowded bulbs.

In Canterbury the heaviest crop, one of 40 tons an acre, was grown by Mr. F. W. Gartery, Springbank, who used land skim-ploughed out of grass in July and deeply ploughed in November, and who sowed 14 oz. an acre of Green Globe in 7 in. rows at the end of December. The turnips were cross-harrowed. Carbonate of lime and superphosphate in equal parts was used at the rate of 2 cwt. an acre.

Carrots.

In the competitions carrots were confined almost wholly to Taranaki, but the heaviest crop, one of 88 tons 8 cwt. an acre, was grown at Putorino in the Wanganui district by Mr. B. Newnham, who sowed on the 19th October 12 oz of Matchless White an acre in 18 in. drills on land which was occupied by mangels the previous year.

In Taranaki Mr. J. Paulger grew the heaviest crop, of 74 tons 16 cwt. an acre, on land ploughed out of grass at the beginning of September. The land was worked very thoroughly, being disked twelve times and line-harrowed four times. Matchless White was sown at the rate of 8 oz. an acre in 11 in drills on the 2nd November. The crop received the following fertilizer an acre: 2 cwt. of superphosphate, 1 cwt. of 30 per cent. potash salt, and 1 cwt. of blood-and-bone. In Hawke's Bay the winning crop, of 53 tons 1 cwt. an acre, was grown by Mr. P. G, Nickolaisen, Norsewood, who sowed Guerande in 14 in. rows.

Miscellaneous Crops.

Chou moellier crops featured in the competitions in Hawke's Bay and South Taranaki. In the former district Mr. G. Kells, Norsewood, grew an excellent crop of 46 tons 12 cwt. by sowing in 28 in. drills and thinning the plants to 15 in. apart. He ploughed early and applied 5 cwt. of ammoniated superphosphate prior to the sowing of the seed and a further 3 cwt. of superphosphate at the time of sowing. The crop was intertilled three times. The heaviest crop in South Taranaki was one of 39 tons 10 cwt., grown by Mr. J. Kaiser, Kaponga.

In various districts competitions were devoted to the following crops: Autumn fodder, maize, lucerne, red clover, potatoes, and green feed. While these competitions did not yield comparable data of general interest they indicate that the competition work can be adapted to the cropping problems of practically any district.

Economic Farm Competition.

A Southland competition, intrinsically of outstanding value, being based on economic considerations, calls for particular mention. The work of judging involved three visits to each of the competing farms,

which are divided into two classes—(*a*) over 250 acres, and (*b*) under 250 acres. The following tables contain the marks allotted to the farms gaining first and second places in each class :—

Farms over 250 Acres.

Points.	Max.	Competitors.	
		J. T. May, Thompson's Crossing.	A O Fleming, Grove Bush.
Steading, yards, &c.	50	43·5	37
Subdivision, fences, shelter, &c.	40	30·5	33 5
Pastures	145	116	116
Crops—cereal, fodder, stacks ..	100	65	87
Drainage, &c	40	37	30
Implements and plant ..	25	23	20
Stock, carrying-capacity ..	175	149	135·5
Absence of weeds and rabbits..	25	18	22
Economics	400	344	284
Totals	1,000	826	765

Farms under 250 Acres.

Points.	Max	Competitors.	
		R. H. Dickie, Tuturau.	R. S. Graham, Mataura Island.
Steading, yards, &c.	50	35·5	37·5
Subdivision, fences, shelter, &c	40	33	38
Pastures	145	109	115
Crops—cereal, fodder, stacks ..	100	93	80
Drainage, &c.	40	33·5	29·5
Implements and plant ..	25	20	20
Stock, carrying-capacity ..	175	150	135
Absence of rabbits and weeds..	25	17	17
Economics	400	283	288
Totals	1,000	774	760

Ensilage and Hay.

The North Taranaki hay and ensilage competitions are described in the December, 1934, issue of the *Journal.* The principal results in other districts were :—

ENSILAGE.

Central Auckland.—Mr. A. Hill, Mauku.

Rotorua.—Mr. C. Musker, Tirau.

South Taranaki.—(*a*) Stack, Messrs. McGuinness Bros., Mangotoki ; (*b*) Pit, Mr. R. C. Treweek, Matapu.

Gisborne.—Messrs. J. Davenport and H. Davis equal.

East Coast.—Mr. L. S. Thomas.

Wairoa.—Mr. P. J. Brewster.

Pahiatua.—(*a*) Stack, Mr. T. G. Penfold, Konini ; (*b*) Pit, Mr. A. Booth, Kaitawa.

HAY.

Central Auckland.—Mr. E. W. Hill, Mauku.

Rotorua.—Mr. T. A. Turner, Rotorua.

South Taranaki.—(*a*) Meadow, Mr. H. Ward, Tokaora ; (*b*) Lucerne, Mr. A. T. Burke, Lowgarth.

Westland.—Mr. C. Frankpit, Coal Creek.

Pasture Competitions.

The popular North Taranaki pasture competitions were discussed in the September, 1934, *Journal*. A pasture competition in the Central Auckland district was won by Mr. A. Woolsey, Patumahoe. Pasture competitions were also conducted in the Rotorua and Westland districts.

VERTICILLIUM-WILT OF POTATOES.

ITS APPEARANCE, CAUSE, AND EFFECT ON YIELD.

E. E. Chamberlain, Mycological Laboratory, Plant Research Station, Palmerston North.

Verticillium-wilt of potatoes causes considerable annual loss to growers in New Zealand. This disease has been recorded as occurring on potatoes throughout Europe and North America. It is known to have been prevalent in this Dominion for a number of years, but it was not recorded on potatoes until 1931. (Cunningham, 1931.)

Symptoms.

The first sympton of the disease is a rapid wilting of the leaves accompanied by the loss of their normal bright green colour. The foliage turns yellow and the plant dies (Fig. 1). Frequently the wilt occurs on only one of several stems of the plant, and, although remaining stems sometimes wilt later in the season, it is not uncommon for one or two to die, other portions of the plant remaining healthy (Fig. 2).

Under the conditions existing in New Zealand the disease usually appears at or just after flowering, and, since death rapidly follows wilting, infected plants die long before healthy ones reach maturity. In the early stages the stems of infected plants display no outward sign of the disease, but on cutting them transversely the vascular bundles are seen to be discoloured a light-brown. This discoloration may sometimes be traced down the stems to the tubers, where it appears as a vascular discoloration at the " heel " or " stem-end."*

Economic Importance.

Verticillium-wilt occurs in every potato-growing district in New Zealand. The two varieties Aucklander Tall-top and Aucklander Short-top appear to be particularly susceptible, and an infection of over 30 per cent. has been observed in a crop of the former.

* Many species of fungi other than that causing verticillium-wilt are capable of entering the tuber and bringing about a discoloration at the stem-end. As will be shown in a subsequent article, there is not necessarily any correlation between vascular discoloration of the tubers and verticillium-wilt of the plants.

The effect of the disease on yield has been determined by a yield trial conducted at this station. The seed tubers were taken from one line of potatoes, an attempt being made to obtain an infected and a healthy line by selecting tubers from wilt-infected and healthy plants.

FIG 1. POTATO-PLANT INFECTED WITH VERTICILLIUM-WILT.
Healthy plant on right. [*Photo by H Drake.*

The plants were grown in replicate plots of ten plants per plot. The difference in wilt infection and crop yield may be seen from the following table :—

Table 1.—The Effect of Verticillium-wilt on Crop Yield.

	Number Setts.	Wilt Infection.		Yield. In Tons per Acre.				Yield. Difference	
		Per-centage.	Difference.	Table.	Seed	Pig	Total.	In Tons.	Per-centage.
Healthy line	100	13†	54	3·7	2·3	1·1	7·1	2·0	28
Infected line	100	67		2·9	1·4	0·8	5·1		

* The field count of wilt infection was checked by making fungous isolations from the stems, only those plants yielding *Verticillium albo-atrum* being classed as infected.
† The causal organism spreads from plant to plant through the soil, and in plants infected late in the season the fungus may reach the tubers without inducing any foliage symptoms. It seems probable that the parent setts of these plants became infected in this way.

For the difference of 54 per cent. wilt infection to cause a 28-per-cent. reduction in yield, the wilted plants must have yielded only half as much as the healthy.

Life History of the Causal Organism.

In other countries potato-wilt is caused by either *Verticillium albo-atrum* Reinke and Bert. or by *Fusarium* spp. (McKay, 1921 ; Goss,

FIG. 2. POTATO-PLANT SHOWING ONE STEM INFECTED WITH WILT WHILE THE REST OF THE PLANT REMAINS HEALTHY.

[*Photo by H. Drake.*

1923, 1924). It has been shown that in New Zealand the wilt is caused by *V. albo-atrum* (Chamberlain and Brien, 1933), and that in a number of lines of potatoes examined this was the only organism responsible for the disease (Chamberlain, 1935).

V. albo-atrum has been recorded as attacking a wide range of host plants (Rudolph, 1931), but in New Zealand it has been isolated from only potatoes and tomatoes (Chamberlain and Brien, 1933).

The life history of *V. albo-atrum* has been described in detail by Rudolph (1931). The fungus is a soil organism and is able to live on decaying organic matter. It enters the plants through the uninjured roots and grows along the vascular bundles into the stem, where,

FIG. 3. VERTICILLATE CONIDIOPHORES OF VERTICILLIUM ALBO-ATRUM × 270.
(*v*) Verticils; (*c*) Conidia. (Original.)

by blocking the vessels, it cuts off the supply of water to the leaves, thus bringing about wilting and death of the plant. The fungus penetrates to the tips of the branches and also travels along the underground portions of the stems and enters the tubers. Tubers thus infected if used as seed produce infected plants. The fungus may spread from infected to healthy plants through the soil.

During the course of attack the fungus is confined to the vascular bundles, but immediately the plant dies it spreads through all the tissues. Under favourable conditions it grows out to the surface of the dead plant, usually at the base of the stems, where it forms a white mycelium, from which arise the conidiophores or fruiting branches. Along the main axis of each conidiophore arise whorls of short branches or verticils which bear small spores (conidia) at their tips (Fig. 3). These spores may be carried by the wind to uninfected soil, where, under favourable conditions of humidity and temperature, they germinate and produce a mycelium. The spores do not survive winter conditions,

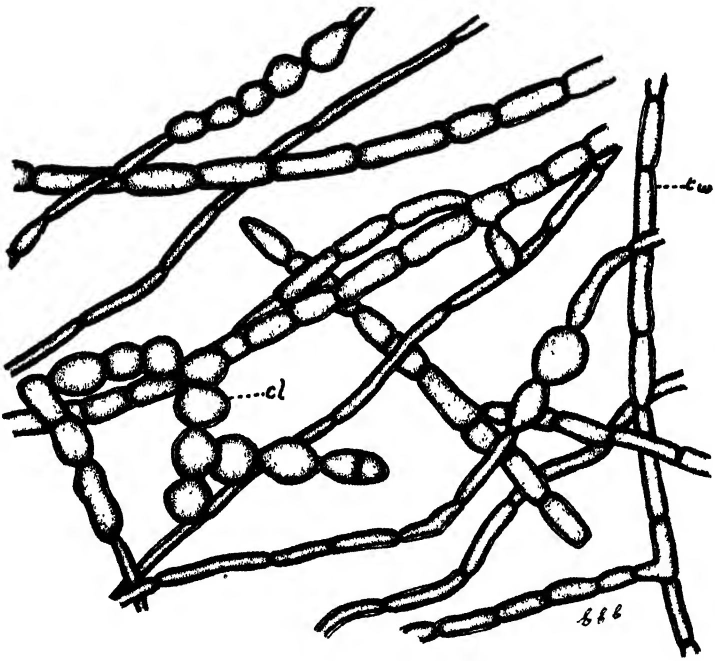

FIG. 4. RESTING MYCELIUM OF VERTICILLIUM ALBO-ATRUM × 825.
(*tw*) Thick-walled hyphæ; (*cl*) Chlamydospores. (Original.)

but when the fungus becomes established in the soil it forms a resting-stage. This consists of dark-brown, thick-walled hyphæ and chlamydospores (Fig. 4), and in this form the fungus is able to persist in the soil for several years.

It was pointed out by Pethybridge (1916) that not necessarily all the progeny of a wilted plant became infected. This was confirmed by the work of McKay (1921), and has also been demonstrated by experiments carried out at this station. Thus in Table 1 it may be seen that, although all tubers selected for the "infected line" were harvested from wilt-infected plants, only 67 per cent. of the plants developed wilt.

On the other hand, *V. albo-atrum* may be present in tubers from plants which have shown no sign of wilt during the season. Thus, in Table 1, of the one hundred tubers selected from apparently healthy plants thirteen produced plants which developed wilt.

The incompleteness of transmission of verticillium-wilt to the tubers and its presence in tubers from apparently healthy plants was further shown in an experiment in which stem-end isolations were made from tubers of healthy and infected plants. The results are given in Table 2.

Table 2.—Occurrence of Wilt-infected Tubers from Healthy and Infected Plants.

Apparently Healthy Plants			Wilted Plants.		
Number of Plants.	Number of Tubers.	Number of Tubers infected.	Number of Plants	Number of Tubers.	Number of Tubers infected.
100*	100	18	100*	100	51
1	8	2	1	10	1
1	8	2	1	9	6
1	8	0	1	7	5
1	6	2	1	7	3
1	6	0	1	6	3
1	5	0	1	5	3

* Isolations were made from one seed-size tuber selected from each plant

SUMMARY.

(1) Potato-wilt in New Zealand is caused by *Verticillium albo-atrum* Reinke and Bert.

(2) It has been shown that the disease may cause a 50-per-cent. reduction in yield.

(3) All tubers of a wilt-infected plant do not necessarily become infected.

(4) The fungus may be present in tubers from plants showing no foliage symptoms of wilt.

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A trial relative to the improvement of grassland by surface sowing was laid down three years ago on a private farm of fairly heavy land near Palmerston North. The area was harrowed three times prior to sowing of the seed. A strip half a chain wide was pegged off as a control, and on this strip no seed was sown. The mixture sown was: 20 lb. certified rye-grass, 10 lb cocksfoot, 3 lb. dogstail, 2 lb. white clover; total, 35 lb. an acre. During the first twelve months there was but little evidence to justify the added expense of the surface sowing, but during the last two years the contrast between the control strip and the remainder of the paddock has been very marked The surface-sown area has a sward markedly superior to the control, and presents evidence of free establishment of perennial rye-grass, cocksfoot, and dogstail, while the control area is showing principally white-clover growth with a sprinkling of inferior annual plants.

FRUIT-TREE ROOTSTOCKS.

METHODS OF VEGETATIVE PROPAGATION.

C. E. WOODHEAD, Plant Research Station.

STOCKS for fruit-trees have been, and still are, largely raised from seed, and it cannot be denied that this method has its advantages in that the stocks are easily raised and little labour is required. A serious objection, however, to this procedure is that few species of fruit-trees are capable of producing seedling progeny true to type and of a uniform character, and consequently the material thus raised is always more or less variable. The influence of the stock on the general behaviour of the tree and the desirability of having pure races of stocks is now generally recognized, and methods of vegetative propagation are being investigated to secure greater uniformity in stock material.

Trials have been carried out during the past two years at the Plant Research Station, Palmerston North, to determine the best means of multiplying vegetatively various types of apple, pear, cherry, and plum rootstocks imported from the East Malling Research Station, England. The following is a description of two methods which have given satisfactory results.

STOOLS.

The young trees which are to form the "stools" are planted 2 ft. apart in rows, the distance between the rows being 3½ ft. A year later each plant is cut back to 2 in. above ground-level, this treatment resulting in the growth of a number of new shoots When these have attained a height of about 4 in. soil is drawn round the base of the shoots in similar fashion to the "earthing-up" of a potato crop; additional soil is added as growth proceeds until each "stool" is moulded up to a height of from 6 in. to 8 in. No further attention is required until early winter, when the soil is removed and the rooted plants severed at the base from the parent stool. The stools are then left exposed until a new crop of shoots is produced the following spring.

This method of propagation has been applied at the Research Station to the following apple stocks, with very satisfactory results: East Malling, Nos. I, IX, XII, XIII, XV, and XVI.

With regard to the Northern Spy stock, covering the stools with about an inch of soil in early spring just as the buds are swelling is necessary to ensure satisfactory root-production. The reason for this procedure is explained below.

LAYERS.

One-year trees are planted in rows with the stems forming an angle of 30 degrees with the ground and lying along the rows, which are 4 ft. apart. The distance between individual plants in the row should be 3 ft. During the winter following that of planting the trees are lightly pruned and pegged down in a shallow trench so as to lie about 2 in. below ground-level (Fig. 1). When the buds commence to swell in spring the stems should be completely covered with about 1 in. of

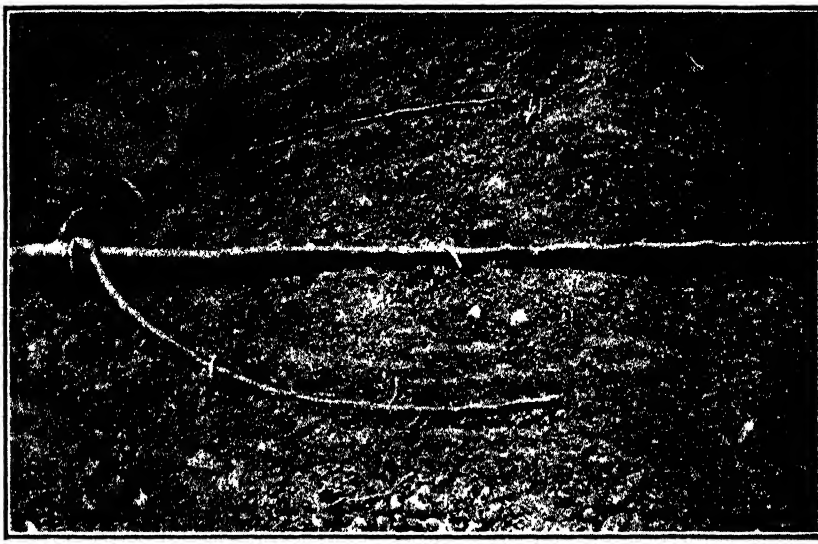

FIG. 1. METHOD OF LAYERING A TREE.

[Photo by H. Drake.

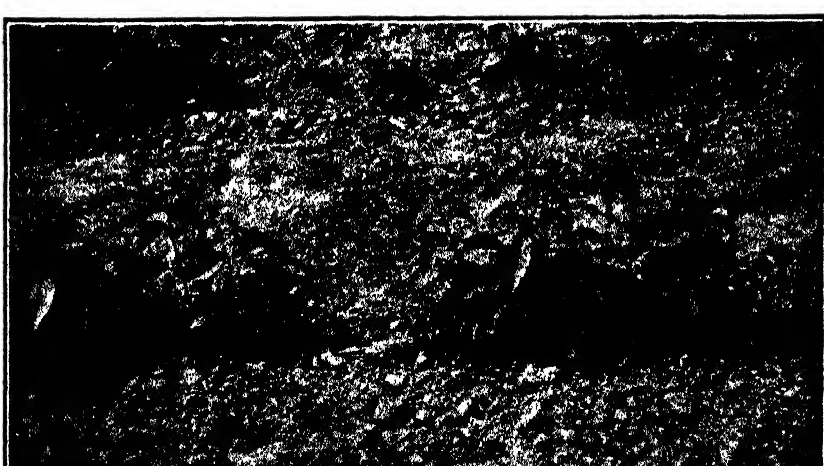

FIG. 2. NEW SHOOTS ARISING FROM LAYERED STEM OF CHERRY.

[Photo by H. Drake.

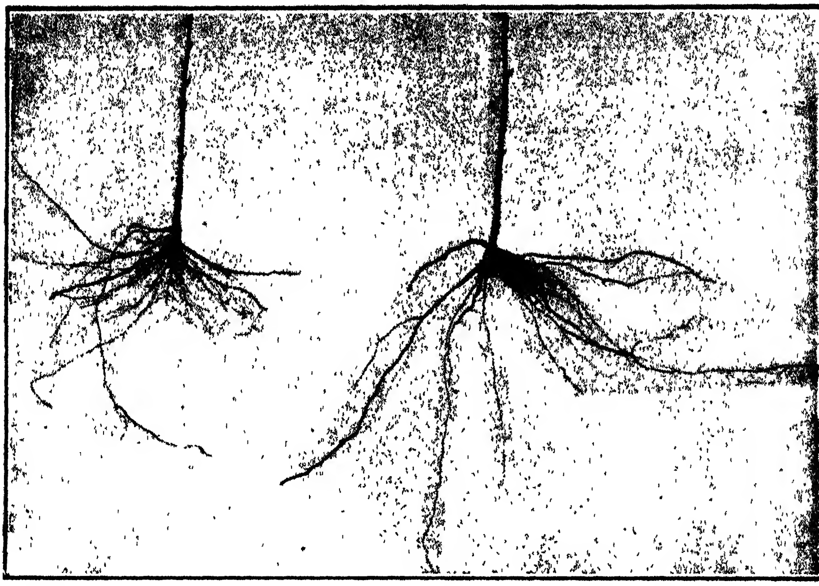

FIG. 3 ROOTED SHOOTS OF MAZZARD CHERRY.

[Photo by H. Drake

FIG. 4. ROOTED SHOOTS OF WILD PEAR.

[Photo by H. Drake.

soil. The success of this method depends on this soil-covering being applied at the time stated and to the correct depth. The new shoots have thus to force their way through this soil layer (Fig. 2), and the part of the shoot below ground remains white and sappy. It has been found that stems in this condition produce roots much more freely than when allowed to become hardened by exposure to the light. Moulding-up should keep pace with growth until the shoots have about 6 in. of soil round them, after which they can remain undisturbed for the rest of the growing-season.

Early in winter the soil is removed and the rooted plants severed from the parent stems, which are left exposed until the following spring. Shoots which have failed to root may be allowed to remain for subsequent "pegging down."

Figs. 3 and 4 show rooted plants of Mazzard Cherry and Wild Pear (*Pyrus communis*) respectively, after severing from the layered parent tree.

Pears, cherries, and plums, which do not root freely on "stools," can usually be induced to furnish well-rooted plants by adopting the layering method. At the Research Station this has been applied successfully to the following stocks:—

Pear: Selected seedings of the Wild Pear (*Pyrus communis*).

Cherry: Several types of the Mazzard Cherry (*Prunus avium*).

Plum. Brompton, Common Mussel, Pershore, Myrobalan B, and Black Damas C.

The two last-named plum stocks can, however, be propagated very readily and with less labour by means of hardwood cuttings.

In addition to the stocks above mentioned, the following commercial varieties of apple produced rooted plants when treated as layers: Cox's Orange, Delicious, Gravenstein, Jonathan, and Sturmer.

There are various factors affecting the degree of success attained in either of the two methods described. One of these is the age of the stools or layers. Rooting will become progressively better as the parent trees increase in age and the crop of shoots becomes more numerous and less coarse. The supply of moisture and the character of the soil also have a great influence on the results obtained, the ideal conditions for root-development being a sandy soil with an ample rainfall.

The fact that the estimated average production per cow for the 1933–34 season exceeded the highest average production previously recorded may be attributed partly to the weather conditions, which, although extremely variable, have, in general, been favourable for the production of butterfat—a well-distributed rainfall generally in the main districts compensated to a considerable extent for the smaller amount of top-dressing which was carried out. The relatively satisfactory average herd production may also be attributed partly to better provision of reserves of feed for use in those periods when the supply of feed directly available from grassland is unsuited to or less than the current needs of the stock—the increase in the area of grass and clover cut for hay and silage from 421,582 acres in 1931–32 to 517,469 acres in 1932–33 and substantial increases in the acreages of mangels and lucerne constitute evidence of this. Better farm-management in respect to other matters, such as improved pasture utilization and previous effort towards herd improvement, almost certainly also was operative.—*Report, Director-General of Agriculture.*

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H. ALLAN, Plant Research Station, Palmerston North.

9. An Asiatic Knotweed.

THE plant here discussed belongs to the genus *Polygonum*. This genus, closely related to the docks, is represented in New Zealand by one indigenous and several weedy introduced species. Well known among these are persicary or redshank (*P. Persicaria*), wireweed (*P. aviculare*), and bind weed (*P. Convolvulus*). Several other ornamental species are fairly commonly grown in New Zealand gardens, and tend to escape therefrom—*e.g.*, the prince's feather (*P. orientale*) and the snakeweed (*P. bistorta*). Buckwheat (*Fagopyrum esculentum*), occasionally grown in New Zealand, is also a closely-related species.

The plant under discussion, *P. cuspidatum*, is a native of Japan and China, and is sometimes grown in New Zealand gardens as an ornamental plant. It is a very vigorous grower, forming stout, bushy clumps, emerging from very thick, swollen basal stems. The aerial stems reach from 4 ft. to 8 ft. high, curving outwards, spotted or streaked with purple, and bearing luxuriant foliage. The leaves are broad, from 4 in. to 5 in. long, and pale-coloured below. They are rather abruptly narrowed to a short-pointed tip, and are square-cut or slightly heart-shaped at the base. The small white flowers are produced in small panicles in the axils of the upper leaves, the floral parts browning and broadening at fruiting-time. The above-ground parts die down in the winter, the plant persisting by its very stout underground stems. These tend to spread from the parent clump till large masses are formed.

It is a fairly useful plant for bold mass effects in large gardens, and for hiding rubbish-heaps or other unsightly spots. Unfortunately its vigorous root-system and spreading habit make it a nuisance when it escapes from cultivation.

My attention to its potential danger was drawn by Dr. W. Mackay, of Greymouth, where it encroaches on footpaths, and has so strongly established itself that eradication is proving difficult. Specimens have also been sent in from near New Plymouth, Inglewood, Masterton, and Hokitika. When sending specimens from Inglewood some years ago Mr. R. W. Brown wrote, " It has been in a paddock for a number of years and is spreading considerably." It has also been observed in waste places about Auckland, and taking charge of neglected gardens.

Also occasionally grown in gardens is " Sacaline " (*P. sachalinense*). This Asiatic species is still more vigorous, spreading rapidly by means of its underground shoots, and sending up tall stems, which may reach a height of 12 ft. The leaves are longer (up to 1 ft. or more) and narrower, more definitely heart-shaped at the base. The panicles are smaller and the flowers greenish. It has been grown for forage, but is not

worth consideration in New Zealand from that point of view, and has not great merit from the ornamental one. I have no record of it as a naturalized plant, but it certainly tends to escape from gardens, and if established would be a serious pest.

POLYGONUM CUSPIDATUM

Small patches of these knotweeds could be carefully grubbed out, leaving no portion of the root-system, but larger areas would involve a great deal of work in controlling. Probably repeated applications of sodium chlorate would prove effective.

The Instructor in Agriculture at Ashburton reports that last year a mid-Canterbury farmer, being unable to dig potatoes because of continued wet conditions, had an iron band fitted to the digger and ran this under the sets in the rows of potatoes The rows dried much more quickly, digging was easier, and the tubers came free from earth.

LOCALITY IN RELATION TO SEED-POTATO PRODUCTION.

EXPERIMENTS ON THE EFFECT OF PLACE OF GROWING ON YIELD AND INCIDENCE OF VIRUS IN POTATOES.

Fields Division.

THE importance of renewing periodically stocks of seed potatoes from selected localities such as Scotland or the North of Ireland has long been recognized by progressive potato-growers in Great Britain. Recent experiments(1) conducted in Wales have indicated that localities in North Wales can lay claim to the same advantages as the abovementioned regions in the production of healthy seed and that the vigour of the seed from such suitable districts is bound up with relative freedom from virus diseases which in turn is largely dependent on the degree or the time of attacks of green aphis (*Myzus persicae*).

In order to investigate the suitability for the production of seed relatively free from virus of certain localities in the South Island of New Zealand two series of experiments have been conducted over the past few seasons and a third series of experiments is at present being carried out. The experiments are referred to in this report under the headings—(1) Southland - grown versus Ashburton - grown seed; (2) trials of locality of growing seed (Arran Chief); (3) trials of locality of growing seed (Dakota).

In each series seed, originally from the same line, was grown in various localities which could be described as either (*a*) commercial potato-growing districts or (*b*) districts which by virtue of their climate might be more suitable for the production of seed potatoes than others. The centres at which seed was grown are shown on the map (Fig. 1). The approximate height above sea-level of each centre is also given.

Seed from each locality was forwarded for inclusion in a central trial each year. The results of such trials to date are presented below.

SOUTHLAND-GROWN VERSUS ASHBURTON-GROWN SEED.

This series of experiments was carried out in co-operation with Mr. W. Dyett, West Plains, Invercargill, who grew a line of Arran Chief potatoes, supplied from the Ashburton Experimental Farm, for several years. Each season seed from Mr. Dyett's crop was returned to Ashburton and tried out against seed from the same line but grown continuously at Ashburton. Some of Mr. Dyett's seed was also grown at Ashburton in an "increase" block and seed from the latter included in trials during subsequent years.

The following results were secured in the yield trials carried out at Ashburton over a period of four years.

Season 1927–28.—The trial was planted on the 11th October, 1927. Two lots of seed were selected from each line from the 1926–27 crop; seed about and averaging 2½ oz. and seed about and averaging 1½ oz. in weight. There were eighteen replications of plots in which large seed were sown and sixteen replications of plots containing small seed.

(1) "Virus Diseases in relation to Commercial Seed Production." Whitehead, Currie, and Maldwyn Davies. *Ann. of App. Biology*, XIX, No. 4, Nov., 1932.

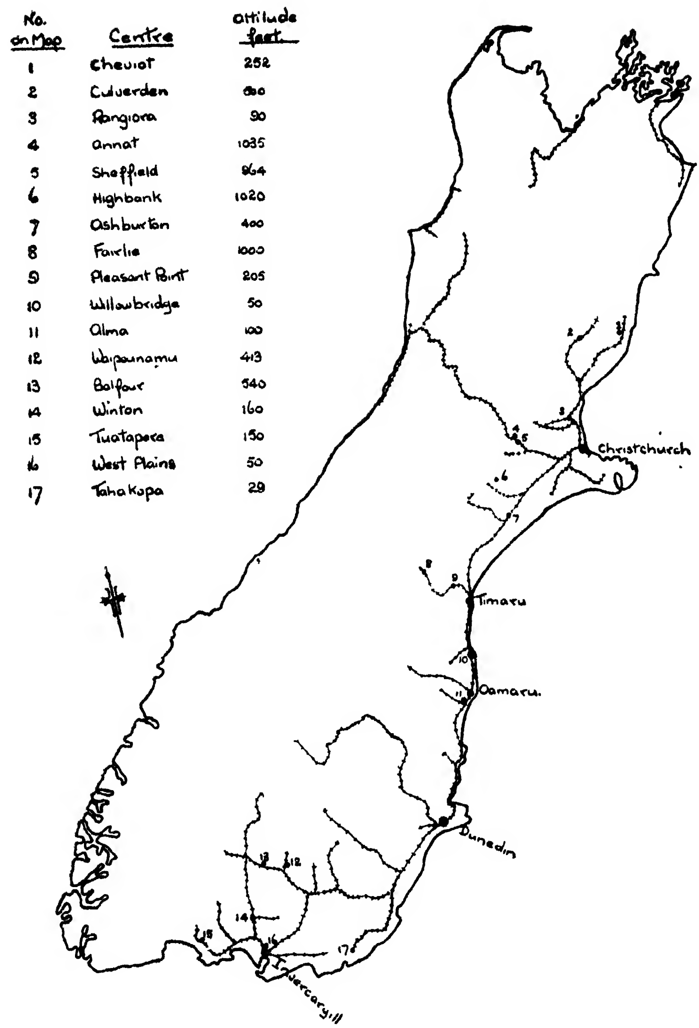

FIG. 1. MAP OF SOUTH ISLAND SHOWING GEOGRAPHICAL POSITION AND APPROXIMATE ALTITUDE OF EACH CENTRE AT WHICH SEED WAS GROWN FOR THE EXPERIMENTS.

Table 1.—Summary of Yields in 1927–28 Season.

History of Seed.	Yield in Tons per Acre.			
	Large Seed.		Small Seed.	
	Table.	Seed.	Table.	Seed.
Ashburton-grown	4·2	3·4	5·0	2·9
Southland-grown	4·1	3·4	5·0	2·7

Differences in yield were not significant. As Mr. Dyett did not keep seed from his 1927–28 season's crop, a further supply of Ashburton seed was forwarded and grown by him in 1927–28 for a trial in the 1928–29 season.

Season 1928–29.—The trial was sown on the 9th October, 1928, and contained thirty replications. In this and subsequent trials only one size of seed was used.

Table 2.—Summary of Yields in 1928–29 Season.

History of Seed.	Yield in Tons per Acre.	
	Table.	Seed.
Ashburton-grown ..	3·03	3·54
Southland-grown ..	4·30	4·09
Increase of Southland over Ashburton	1·27	0·55

The above increases were significant. The benefit derived from growing seed one season in Southland coincided with a heavy aphis invasion in Canterbury during the 1927–28 season.

Season 1929–30.—The lines of seed included in the trial were—(1) Ashburton seed (continuously grown at Ashburton for three seasons); (2) Ashburton seed grown in Southland for one year and then again grown at Ashburton for one year; (3) Ashburton seed grown in Southland for two years. The trial was sown on the 25th October, 1929. The plots were replicated forty-two times. Disease counts were taken during the growing-period.

Table 3.—Summary of Yields and Disease Counts in 1929–30 Season.

Seed as described above.	Incidence of Virus.	Yield in Tons per Acre.		Increase of (2) and (3) over (1) (Ashburton).	
		Table.	Seed.	Table.	Seed.
	Per Cent.				
(1)	63	2·3	2·2	..	..
(2)	42	2·9	2·6	0·6	0·4
(3)	39	3·3	2·5	1·0	0·3

The increases of lines (2) and (3) over line (1) were significant. The differences between (2) and (3) were not statistically significant.

Season 1930–31.—The experiment was sown on the 12th November, 1930, the following lines of seed being under trial: (1) Ashburton seed (continuously grown at Ashburton four seasons). (2) Seed from Ashburton grown for one season in Southland (1927–28) and for two seasons at Ashburton (1928–29 and 1929–30). (3) Seed from Ashburton grown for two seasons in Southland (1927–28 and 1928–29) and again at Ashburton for one season (1929–30). (4) Seed from Ashburton grown for three seasons in Southland (1927–28, 1928–29, and 1929–30). There were forty replications. Disease counts were taken on the 9th March, 1931.

Table 4.—Summary of Yields and Disease Counts in 1930–31 Season.

Seed as described above.	Incidence of Virus.	Yields in Tons per Acre.			Increase of (2), (3), and (4) from (1) (Ashburton).		
		Table.	Seed.	Total.	Table.	Seed.	Total.
	Per Cent.						
(1)	70·9	2·7	3·4	6·1	..	..	..
(2)	39·5	3·3	3·8	7·1	0·6	0·4	1·0
(3)	30·0	3·6	4·2	7·8	0·9	0·8	1·7
(4)	25·4	3·2	3·9	7·1	0·5	0·5	1·0

The yield of Ashburton (continuously grown) seed is significantly lower than the remainder. Line (3) (see grown two years in Southland and then one year at Ashburton) is significantly better than line (4) in all grades and significantly better than line (2) in seed and total potatoes.

It is difficult to understand the inferiority of line (4) (seed grown for three years in Southland) as compared with line (3) (seed once grown at Ashburton after two years in Southland). The disease counts do not indicate an appreciable difference in the amounts of virus, and, according to Mr. Cottier, Assistant in Entomology, aphid infestation, which is regarded as being the prime factor in the spread of this group of diseases, was generally worse in the Ashburton district than in Southland during the 1929–30 season.

The above-described series of experiments was not repeated after the 1930–31 season, since other trials were then established having the same objective and the Experimental Farm at Ashburton was being closed down.

TRIALS OF LOCALITIES OF GROWING SEED (ARRAN CHIEF).

A line of Arran Chief potatoes, which could be described as a medium commercial line moderately infected with virus, and grown at the Ashburton Experimental Farm in the 1928–29 season, was distributed amongst the undermentioned farmers, and crops were grown by them in the 1929–30, 1930–31, and 1931–32 seasons: B. Richardson, Willowbridge, Canterbury; T. Hanna, Rangiora, Canterbury; J. Cooper, Alma, North Otago; A. McGiffert, Cheviot, Canterbury; R. Wilson, Highbank, Canterbury; A. F. Campbell, Fairlie, Canterbury; J. Cowie, Balfour, South Otago; L. Wright, Annat, Canterbury; Experimental Farm, Winton, Southland.

A portion of the same line was retained at Ashburton and grown there during the first two seasons mentioned above. In the 1931–32 season owing to the closing-down of the Ashburton Experimental Farm seed of the original line was grown on the farm of the Rangiora High School.

At the close of each season a portion of the seed grown by each co-operating farmer was collected and forwarded for inclusion in a central trial, where the subsequent crop was compared with that from the original line in regard to its yield and amount of virus. The central trials were carried out at Ashburton in 1930–31 and at Rangiora High School in seasons 1931–32 and 1932–33.

Layout and Details of Central Yield Trials.

All the lines of seed were grown under the same conditions as regards manuring and cultivation and an equal number of "sets" was planted in each plot. Plots were replicated forty times, and in seasons 1930–31 and 1931–32 the control line (Ashburton) occupied every third plot so that yields could be examined by "students'" method.

In the 1932–33 season forty replications of plots were set out on the randomized-block method and results were analysed statistically by the analysis of variance method of Fisher and Wishart.

During the growing-season counts were taken on the incidence of virus diseases in the various plots.

Season 1930-31, at Ashburton.—The experiment was laid down on the 11th November, 1930. Disease counts were taken on the 26th February, 1931. The plots were dug and weighed on the 4th June, 1931.

Table 5.—Summary of Disease Counts, Yield of Control, and Difference of each line from Control.

Seed from Crop grown in 1929–30 at—	Incidence of Virus.	Yield of Control and Difference in Yield from Control of each Line in Tons per Acre.		
		Table.	Seed.	Total.
	Per Cent.			
Control (Ashburton) ..	22·4	2·1	1·2	3·3
(1) Willowbridge ..	24·7	−0·2	−0·1	−0·3
(2) Rangiora	21·0	−0·3	0·0	−0·3
(3) Alma	24·9	**−0·8**	−0·1	**−0·4**
(4) Cheviot	23·8	0·0	0·0	0·0
(5) Highbank	23·5	−0·2	0·0	−0·2
(6) Fairlie	21·8	−0·1	0·0	−0·2
(7) Balfour	23·5	**+0·3**	−0·2	+0·1
(8) Annat	21·3	+0·3	−0·2	+0·1
(9) Winton	24·4	−0·3	0·0	−0·3

Differences printed in heavy type are statistically significant.

Table 5 shows that there were no appreciable differences in the incidence of virus in the crop from each line of seed. The seed from Alma gave a significantly lower yield than control, and that from Balfour was significantly higher than control in table grade, but differences were only small. The crop was a very poor one owing to late planting and dry weather.

Mr. Cottier, Assistant in Entomology, who inspected the crops grown for seed in 1929, commented on the yields as follows: "In the table of yields the only significant lowering in yield is shown from the one at Alma. In records of numbers of insects on these crops in December, 1929, the aphis *Myzus persicae* was considerably more abundant on this crop than on any of the others. In my glass-house experiments it has been shown that of the characteristic insects of the potato foliage this one is the main insect carrier of leaf-roll."

Season 1931–32, at Rangiora High School.—The experiment was sown on the 2nd November, 1931. Disease counts were taken on the 6th February, 1932. The plots were dug and weighed on the 31st May, 1932.

Table 6.—Summary of Disease Counts, Yield of Control, and Difference of each Line from Control

Seed from Crop grown in 1930–31 at—	Incidence of Virus.	Yield of Control and Difference in Yield from Control of each Line in Tons per Acre.		
		Table	Seed	Total
	Per Cent			
Control (Ashburton) .	38·8	0·7	4·5	5·2
(1) Willowbridge ..	41·2	+0·1	−0·1	0·0
(2) Rangiora	45·8	**+0·2**	−0·3	0·1
(3) Alma	46·5	+0·1	−0·3	−0·2
(4) Cheviot .. .	45·7	**+0·3**	−0·1	−0·2
(5) Highbank	24·6	**+0·3**	**+0·5**	**+0·8**
(6) Fairlie ..	23·6	**+0·2**	**+0·7**	**+0·9**
(7) Balfour . ..	23·7	+0·2	+0·3	**+0·5**
(8) Annat	21·0	**+0·3**	**+0·6**	**+0·9**
(9) Winton	17·6	**+0·3**	**+1·4**	**+1·7**

Differences printed in heavy type are statistically significant

As indicated in Table 6, owing to extremely dry conditions in late summer, the crop was poor and gave rise to a large proportion of seed-sized tubers. In the case of control and lines (1), (2), (3), and (4) the incidence of virus was greater than on the previous season (see Table 5). In each of lines (5), (6), (7), and (8) the percentage of virus was appreciably lower than the remainder, and was approximately the same as in the previous season. The yields of these relatively low virus-infected lines were in all cases significantly higher than control (Ashburton) in total potatoes, and with the exception of line (7) (Balfour) were also significantly better than control in table and seed grades.

Season 1932–33.—In the 1932–33 season's yield trial, which was again carried out at Rangiora High School, seed grown at Highbank and Fairlie was not available for inclusion. The seed from Willowbridge, although grown in the trial, was found to be so contaminated with rogues of Northern Star that results from this line have not been included in the following table. The trial was sown on the 1st November, 1932. Disease counts were taken on the 8th February, 1933. The plots were dug and weighed on the 12th May, 1933.

Table 7.—Summary of Disease Counts, Yield of Control, and Differences of each Line from Control.

Seed from Crop grown in 1931–32 at—	Incidence of Virus.	Yield of Control and Difference in Yield from Control of each Line in Tons per Acre.		
		Table.	Seed.	Total.
	Per Cent.			
(1) Control*	31·2	1·3	5·0	6·3
(2) Rangiora	62·6	**−0·5**	**−1·4**	**−1·9**
(3) Alma	59·4	**−0·5**	**−0·8**	**−1·8**
(4) Cheviot	57·9	**−0·4**	**−1·8**	**−1·7**
(7) Balfour	27·3	**−0·3**	+0·3	0·0
(8) Annat	14·6	−0·1	**+0·5**	+0·4
(9) Winton	17·6	+0·3	+0·2	+0·5

* Seed grown at Rangiora High School as Ashburton Experimental Farm had been closed down.

The season was again very dry and only low yields as indicated in Table 7 were obtained from the trial. Apart from the unfavourable weather conditions, however, it is evident that the cropping-power of the line of seed used was very poor, since a block of Dakotas grown on the same farm yielded 6 tons table and 4 tons seed potatoes per acre.

Lines (2), (3), and (4) showed a further increase in the percentage of virus over the previous season, and were almost twice as badly infected as the control. The yields of these were also significantly lower than control in all grades. Line (7) showed a similarity to control both in virus-infection and yield, and, although the latter was significantly higher in table, line (7) was heavier in the seed grade by a similar amount, although this difference was not significant. Lines (8) and (9) were appreciably lower in the percentages of virus than control, and the former gave a significant increase in seed grade over control.

It is of interest to note that the control, which was grown from seed raised at Rangiora High School, showed a lessened incidence of virus than the same line in the previous year, which was grown from seed raised at the Ashburton Experimental Farm. While the difference between the two seasons' results as regards virus is only small and could be entirely due to seasonal fluctuations it will be observed that line (2), grown from seed raised within a mile or so of the High School, shows a definite deterioration when the virus infection in 1932–33 is compared with that of 1931–32. It may be asked, Why should one line improve in this respect while another grown in the same district deteriorates? The reason is probably due to the difference in yield of the parent crops grown in the 1931–32 season. The crop grown at the Rangiora High School (0·7 tons table, 4·5 tons seed) contained a very high proportion of seed to table potatoes, whereas the crop grown on the farm of Mr. T. Hanna, Rangiora, yielded 5·3 tons table and 1·7 tons seed potatoes. It is very likely that much of the seed from the latter has been the progeny of virus-infected plants whereas the seed from the Rangiora High School crop would be largely from normal plants, because dry conditions following late planting of the crop

would prevent many of the virus-infected plants from forming even seed-sized tubers. The seed used would then be drawn largely from healthy plants.

Records kept of yields of all the crops from which seed has been taken in this series of trials do not suggest any correlation between yield of a crop or proportion of seed grade to table grade and performance of the seed from that crop, but the explanation given above is feasible when the abnormal nature of the 1931–32 season's crops at Rangiora High School is considered.

TRIALS OF LOCALITIES OF GROWING SEED (DAKOTA).

Owing to the poor cropping-power of the line of Arran Chief potatoes used in the previous series a commencement was made with a further series of trials in the 1932–33 season in which the Dakota variety was used. The fact that Arran Chief is relatively susceptible to mosaic, while Dakota is more susceptible to leaf-roll, and the high-yielding capabilities of Dakota were the main reasons for using the latter variety. Apart from the Rangiora district, in which the central yield trials at the Rangiora High School are to be continued, all the districts selected for growing seed for trial were those having cooler or more vigorous summer conditions than the main potato-growing districts of the South Island. Such districts were—Culverden, Sheffield, Highbank, and Pleasant Point (in Canterbury); Tahakopa (in Otago); Waipounamu, Tuatapere, and Winton (in Southland).

The arrangements for having seed grown in each of the above districts and forwarded each year for inclusion in the central yield trial were the same as those adopted for the Arran Chief series.

It is not intended to discuss the results which have already been obtained in the 1933–34 season until further trials have been carried out. The results, however, confirm those in the Arran Chief series in that marked differences occurred both in virus incidence and yield, the latter being related inversely to the former.

Percentages of virus infection ranged from 7·3 per cent. to 69 per cent, and the difference in yield from the crops showing these extremes of virus was in the nature of 3 tons of table and 2 tons of seed potatoes. Such differences are remarkable in view of the fact that they have been obtained from seed "once removed" from an original line.

SUMMARY.

Three series of experiments to investigate the effect of locality in relation to seed-potato production are described.

Part of a line of Arran Chief potatoes was grown in Southland and part grown at the Ashburton Experimental Farm. In each of the four seasons 1927–28 to 1930–31 the seed grown in each locality was compared in a yield trial. In the last two seasons seed "once grown" from Southland—*i.e.*, grown at Ashburton for one season after having been grown in Southland—was included, while in the 1930–31 season's trial seed "twice grown" from Southland was also included in the yield trial.

In three seasons Southland-grown seed was significantly higher in yield than seed continuously grown at Ashburton. In both seasons where

seed "once grown" from Southland was compared with seed continuously grown at Ashburton the former was significantly higher in yield. In the 1930–31 season's trial Southland-grown seed was significantly lower in yield than seed "once grown" from Southland, and was not significantly different from "twice grown" seed.

In a second series of trials a line of Arran Chief potatoes was divided up and portions grown in the following districts: Willowbridge, Rangiora, Cheviot, Highbank, and Fairlie (in Canterbury); Alma and Balfour (in Otago); and Winton (in Southland). In each of three seasons (1930–31 to 1932–33) seed from each crop was included in a central yield trial. The disease counts (virus infection) taken on these trials indicated progressive increases in percentage of virus infection from seed continuously grown at Willowbridge, Rangiora, Alma, and Cheviot respectively. Potatoes grown from seed raised at Highbank, Fairlie, Balfour, Annat, and Winton respectively showed no increase in the amount of virus during the period of trial. Such differences in virus infection were reflected in the yields, although unfavourable seasons combined with the poor cropping-power of the line of potatoes used precluded any large increases. Even then the differences between the best line and the worst line in total potatoes were—1930–31, ½ ton; 1931–32, 1·9 tons; 1932–33, 2·4 tons.

The districts producing seed giving rise to crops relatively low in virus infection and relatively high in yield were those which by reason of latitude or altitude were possessed of cooler climates than the district supplying the remaining lines under trial.

A third series of trials (uncompleted) in which the Dakota variety is being used are described. The first year's results substantiate those secured in the second series of trials and differences both in virus and yield are far more markedly in favour of seed from cooler districts, such as Sheffield and Highbank (Canterbury), Tahakopa (Otago), and Waipounamu, Tuatapere, and Winton (Southland).

ACKNOWLEDGMENTS.

The first series of trials was initiated by Mr. J. W. Hadfield, Agronomist, and carried out at the Ashburton Experimental Farm by Mr. R. Thomson, Assistant in Agronomy. The second and third series, also suggested by Mr. Hadfield, were carried out by field officers under the direction of Mr. R. McGillivray, Fields Superintendent, Christchurch, and Mr. R. B. Tennent, late Fields Superintendent, Dunedin. Thanks are due to those farmers mentioned who co-operated in carrying out the first two series of trials and to those who are still assisting in the third series. Special mention should be made of the willing co-operation of the authorities of the Rangiora High School for the use of land and facilities over a number of years.

—*A. W. Hudson, Crop Experimentalist.*

—*J. W. Woodcock, Assistant Crop Experimentalist.*

By special order, barberry and broom have been declared noxious weeds by the Pohangina County Council.

By resolutions which were gazetted from the 10th to 31st January last responsibility for the administration of the Noxious Weeds Act has been assumed by the Buller, Matamata, Waipa, Tauranga, Raglan, Waikato, and Whakatane County Councils.

SELECTION OF STARTER CULTURES FOR CHEESE-MANUFACTURE.

A PRELIMINARY NOTE ON A NEW METHOD.

H. R. WHITEHEAD and G A COX, Dairy Research Institute (N Z), Department of Scientific and Industrial Research, Palmerston North.

THE most important property of a good starter culture used in the manufacture of Cheddar cheese is its power to produce acid steadily throughout the making process and at a regular rate from day to day. It is desirable also that the culture should have a clean flavour and pleasant aroma; but, given adequate facilities for the maintenance of starters, this is relatively easy to obtain. Failure, either sudden or gradual, to attain the requisite acid production is by far the commonest fault in starters, and is one of the most important single factors causing spoilage of cheese.

The preparation and selection of cheese starters have for long been a matter of trial and error. All pure and active cultures used in commercial factories are mixtures of several varieties of lactic streptococci: but up to the present the bacteriologist has had no adequate means of deciding whether all the varieties were essential members of the culture, and, if not, which varieties were responsible for the activity of the starter.

Most of the varieties of streptococci in starter cultures can be shown by their sugar reactions to belong to one or other of the two species *Str. cremonis* and *Str. lactis* originally described by Orla Jensen. The few remaining varieties are betacocci and are responsible for the volatile acid and flavouring substances which give the starter its aroma. The betacocci are essential members of the flora of a butter starter where aroma is more important than acid production, but it is doubtful whether thay have any significant function in a cheese starter.

Although the majority of the streptococci present in starter cultures can be classed as *Str. cremoris* or *Str. lactis*, the organisms of both species can be divided into several sub-groups on the basis of colony type, microscopical appearance, sugar fermentations, and acid production. Work at this Institute during several years has been based on an endeavour to correlate any or all of these properties with the acid-producing characteristics of mixed cultures under the conditions of cheese-manufacture.

The general method followed has been to plate out starter cultures on various media, to pick off at least fifty colonies and to attempt to classify the strains thus isolated into groups on the basis of the properties mentioned above. It has been observed that most commercial cultures contain at least three or four varieties of streptococci, and that the proportions of these varieties in the population of the whole culture change markedly from time to time even when the starter is subcultured daily under conditions maintained as constant as possible. Up to a few months ago, however, it did not seem possible to find any connection between population changes or the properties of individual varieties and the properties of the starter cultures as observed by the practical cheesemaker.

Recently, however, investigation of starter streptococci on the basis of a property the importance of which has not hitherto been realized, has opened up a more promising line of work. This new field of inquiry was opened up through the observation that in pure cultures of streptococci there sometimes was a marked lack of correlation between the acid-producing power of certain strains and their ability to bring about a reducing potential in milk, as judged by reduction of methylene blue. Some strains which produced acid quite rapidly in milk at 20° C. or 30° C. decolorized methylene blue rapidly at 37° C.; others, equally rapid acid producers as judged by their power to clot milk, were exceedingly slow in reducing methylene blue at 37° C. (The use of these particular temperatures was in the first place accidental.) When reductase tests of the various pure strains were conducted in duplicate at 30° C. and 37° C. it was observed that all strains which clotted milk readily, decolorized the blue rapidly at 30° C. At 37° C., however, some of these strains were exceedingly slow in bringing about reduction, whereas the others were equally active or only slightly less active than at 30° C.

A microscopic examination of stained smears prepared from the reductase tubes provided a ready explanation of the phenomenon. In all cases where the blue was reduced rapidly the streptococci had a normal appearance and showed active growth. In those tubes in which reduction of the blue was markedly delayed at 37° C. the cocci had a distinctly abnormal appearance; they showed numerous involution forms besides a very much feebler growth. It was apparent that some strains found 37° C. so near to their thermal death-point that they survived only with difficulty.

Now in the manufacture of Cheddar cheese, the mixture of curd and whey in the vat is at one stage raised to a temperature of 37° C.–39° C. (98° F.–102° F.) and maintained at that temperature for 1½ to 2 hours. If a preponderance of the streptococci in the starter were injured by that temperature, one would expect acid-production to be considerably delayed after the application of the heat. Thus the observation in our reductase tests seemed to provide a possible explanation for the fact that some commercial starter cultures are exceedingly slow in developing acid in the curd during the later stages of the cheesemaking process.

The matter was next tested out by the selection of pure strains of streptococci which could be used as starters in the cheese vat. In a mixed commercial culture there are many strains which do not clot milk readily at 20° C. in pure culture; evidently these cannot be used alone as starters since they do not grow rapidly enough whether they withstand a temperature of 37° C. or not. Of the strains which produced acid rapidly at 20° C. several were tested in the cheese-vat. It was found that many of these pure cultures made quite satisfactory starters as judged by appearance, taste, and aroma. They were naturally not as fully flavoured as good butter starter, but they were clean and unobjectionable. As had been predicted from the results of tests in the laboratory, their behaviour in the cheese-vat depended upon whether they could survive and grow normally at a temperature of 37° C. Those types which withstood 37° C. without harm gave excellent results, the acid developing progressively right up to the salting stage. Those types which were damaged at 37° C. produced acid normally during the early part of the cooking period, and the

manufacturing process appeared to proceed normally until the whey was run off (dipped). The low acidity shown by the whey immediately after the curd was dried (piled) was unmistakable evidence, however, of a slowing in acid-production, and this slowness persisted throughout the remainder of the manufacturing process.

Several strains of streptococci which produce acid actively and withstand a temperature of 37° C. were isolated from various commercial starter cultures. They have been used during the past three months in several commercial factories and have in general proved to be very active acid formers. The only trouble has been that in certain cases with no warning they have suddenly failed to produce acid. This has been proved in one or two instances to be due to the phenomenon described by Whitehead and Cox(1) whereby in certain circumstances (undefined at present) an aeration of the starter-milk after pasteurization renders it inhibitory towards the lactic streptococci. This trouble, in factories where it occurred, seemed to coincide with the prolonged dry weather conditions during this season, but whether there is any causal connection is doubtful at present.

In spite of the occurrence of this still unexplained sudden failure, the method described for selection of pure strains is undoubtedly a definite advance in the selection of starter organisms and provides in general a most successful means for the preparation of really active cheese cultures. The organisms selected must have two properties—(1) They must be active acid formers at temperatures of 20° C. to 30° C.; (2) they must be relatively unaffected in their growth and morphology at 37° C. The two properties are to some extent complementary. One strain may be an extremely active former of acid and yet be somewhat adversely affected by a temperature of 37° C. Another strain may be somewhat less active as an acid-producer but be entirely unaffected by the high temperature. The two strains must be subjected to a vitality test(2) in order to determine which will be better in the cheese-vat. In the preliminary work of selection, however, it is possible to exclude quite easily a large number of strains which either do not form acid at a reasonable rate or which are seriously affected at 37° C.

REFERENCES.

(1) Whitehead and Cox *Jour. of Dairy Research*, 1934, 5, 197.
(2) —— *N.Z. Jour. of Science and Tech.*, 1932, 13, 304

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 13th December, 1934, to 24th January, 1935, include the following of agricultural interest.—

No. 73023: Cutting bracken; C. M. Collins No. 72145: Teat-cup; H. F. Taylor. No. 72980: Slicing meat, W. J. Caldwell. No 73054: Centrifugal separator; Aktiebolaget Separator. No. 71101: Hay-sweep, H. R Wilton. No. 72192: Cooling and deodorizing milk; J H Bishop and A H. Beadle. No. 72198: Butter-box; W. H. Parker. No. 72206: Threshing-machine; F. R. Eaden and Andrews and Beaven. No. 73101: Treatment of wool, Wool Industrial Research Association, A. T. King and R. A. E. Galley. No. 73109: Grubbing-implement; A. H. Warren. No. 73129: Grain-scouring machine; C. C. Marston. No. 73170: Wire straining and fastening machine; E. T. James.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

VARIETIES OF FRUIT-TREES FOR COMMERCIAL ORCHARDS.

Horticulture Division.

TEN years ago a list of the most suitable commercial varieties of pip and of stone fruits was published in the *Journal* and in Bulletin No. 84. After consideration of developments in the meantime the amended list, given below, has been prepared recently as one which might form a basis on which to compile a planting-list. For further information about the establishment of orchards, reference may be made to Bulletin No. 84, an amended edition of which is now being obtained :—

Apples *for Export and Local Markets—Dominion List.*

Beauty of Bath.	*Delicious.
Red Astrakhan.	Dunn's (Monroe's Favourite).
Lord Suffield.	Lord Wolseley.
*Gravenstein.	Cleopatra.
Scarlet Pearmain.	Rome Beauty.
Worcester Pearmain.	Granny Smith.
*Cox's Orange Pippin.	Sturmer
Alfriston.	*Dougherty.
Jonathan.	Ballarat.
Reinette du Canada	

Pears—*Dominion List.*

Buerre Bosc.	Giblin's Nelis.
Beurre Clairgeau.	Glou Morceau.
Beurre d'Anjou.	Josephine de Malines
Beurre Diel.	Marie Louise.
Louise Bonne of Jersey.	Twyford's Monarch.
Doyenne du Comice	Packham's Triumph.
Directeur Hardy.	Winter Cole.
Durondeau.	Winter Nelis.

The following varieties may also be grown with satisfaction in localities having canning facilities :—

William's Bon Chretien.	Keiffer's Hybrid.

Peaches—*Dominion List.*

D. denotes dessert ; C., canning ; W., white flesh ; Y., yellow flesh ; F., freestone ; Cl., clingstone ; S.Cl., semi-clingstone.

Early Varieties.

Mayflower. D.W.Cl.	Briggs's Red May. D.W.F.
Sneed. D.W.F.	High's Early Canada. D.W.S.Cl.
Sanders. D.W.F.	Eulates. D.W F.

Second Early.

Hales. D.W.F.	Husted's Early. D.W.F.
Wiggins. D.W.F.	Ideal. D.C.Y.F.
Carman. D.C.W.S.Cl.	Peregrine. D.W.F.
J. H. Hale. D.C.Y.F.	Early Crawford. D.C.Y.F.

* Red strains of these varieties are available and are preferable to the older types.

Mid-season.

Foster D.C.Y.F.
Muir. D.C.Y.F.
Kalamazoo. D.C.Y.F.
H.B. American Pound. D.W.F
Royal Charlotte, D.C.Y.Cl.
Kia Ora. D.C Y.F
Paragon. D C.Y.Cl.

Late Mid-season.

Gold Dust. D C.Y.Cl.
Sea Eagle Impd. D.W.F.
Mary's Choice. D.C.Y F.
Akarana. D W F.

Late Varieties.

Lippiatt's Late Red. D W.Cl.
Golden Queen D C Y Cl
Late Crawford. D.C.Y F.
Solway. C Y.F
Hobb's Late C.W Cl.
Pullar's Cling C.Y.Cl.
McDevitt's Late Cling. C.Y.Cl.

Nectarines—*Dominion List.*

Ansenne.
Cardinal.
Early Rivers.
New Boy.
Goldmine.
Hunt's Tawny.
Victoria.

Plums and Prunes—*Dominion List.*

English

Angelina Burdett.
Coe's Golden Drop
Damson Russian.
Diamond.
Early Orleans.
Early Rivers.
Evans Early.
Grand Duke.
Greengage.
Jefferson
Kirke's
Magnum Bonum (Yellow).
Monarch
Pond's Seedling.
President
Takapuna Drop

Japanese.

Burbank
Billington's Early.
Doris.
Formosa.
October Purple.
Santa Rosa.
Satsuma
Wright's Early.
Sultan

Prunes.

Golden Prune.
Giant
Petite d'Agen.
Tragedy.

Apricots—*Dominion List.*

Bolton.
Hemskirk.
Moorpark.
Newcastle.
Oullin's Early.
Royal Late.
Roxburgh Large Red.

Cherries—*Dominion List.*

Biggareau Twyford.
Early Purple Guigne.
Early Rivers.
Black Eagle.
Biggareau Jabaulay.
Florence.
Black Tartarian.
Biggareau Napoleon.
May Duke.
Early Lyons.
Bedford Prolific.
White Heart.
Knight's Early Black.
St. Margaret (Black).
Werder's Early Black.
Governor Wood.
Bing.

SEED-WHEAT CERTIFICATION.

CERTIFIED CROPS.

UNDER the Government scheme for the certification of seed wheat, the following growers have seed for sale from crops which have passed both field and grain inspections: —

Variety.	Grower.	Acreage.
Cross 7	R. H Johnston, Dunsandel (contract to Canterbury Seed Co)	5
Solid Straw Tuscan ..	W. T Bell, Prebbleton	15
	C. Early, Templeton	20
	R H. Johnston, Dunsandel	44
	F A Tutton, Christchurch-Springston R.M.D.	13
Marquis	*W. Ives, Old Renwick Road, Blenheim ..	5
	*W. A. Litchfield, Middle Renwick Road, Blenheim	12
Hunters II	*G. Fine, Springs Road, Sockburn	18

* Passed subject to machine-dressing of seed.

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Some Considerations relative to Seed-mixtures.

THE purchase of seed-mixtures for the sowing-down of pastures is an important task with which many are faced at this season. The task may be resolved into two main phases: (1) The determination of the particular species and the amount of each to be used, and (2) the economical purchase of suitable seed of the various species required. Assurance of attaining full efficiency in respect to each of these phases can be obtained only by taking into consideration the available knowledge relative to recent developments.

Composition of Seed-mixtures.

One of the outstanding features of modern thought relative to seed mixtures is the trend towards ever greater simplification. The distance travelled in this respect is reflected in a comparison of a mixture approved in the Dominion to-day for extensive use and a mixture of the Clifton Park system of farming which attracted so much attention a few decades ago, which still is accorded respect, and which seems to have influenced considerably the mixtures prescribed in the past for use in New Zealand. The following plants were included in a mixture typical of those sown under the Clifton Park system: Cocksfoot, tall oat grass, golden oat grass, tall fescue, meadow fescue, hard fescue, rough-stalked meadow grass, smooth-stalked meadow grass, Italian rye-grass, kidney vetch, chicory, burnet, sheep's parsley, yarrow, late flowering red clover, white clover, alsike—seventeen species in all. Probably this mixture was seldom if ever duplicated exactly in New Zealand practice, but one of its important features—the inclusion of a wide range of plants—certainly was copied extensively. Against the typical Clifton Park mixture may be considered a mixture which is being used widely in the Dominion with good results and which consists of rye-grass, cocksfoot, dogstail, red clover, and white clover. Though this involves a reduction from seventeen to five species, the question whether in the establishment of permanent pasture it would not prove advantageous at times to reduce the number of species still further is now being asked. Investigations and field experience both in New Zealand and overseas suggest the advisability of employing more freely still more simple mixtures designed to cater especially for a particular season and also usually to fill a particular need. An instance of the successful application of this conception is provided in the so-called "special paspalum pastures," in which *Paspalum dilatatum* is dominant and from which decidedly valuable supplies of leafy feed have been obtained from midsummer into the autumn in the warmer districts to as far south along the coast as Foxton and, may be, occasionally in localities farther south. Another instance, which is not quite a parallel because the key plant is an annual, but which is analogous in essential respects, is the successful use for special purposes of pastures in which subterranean clover is dominant: subterranean clover has for long been observed under normal grazing management in competition with common pasture plants such as rye-grass, cocksfoot, dogstail, brown-top, and other clovers, and generally has been considered as of insignificant value if not as a weed. But subterranean clover, grown with competition so reduced that it dominates the sward and grazed leniently at seasons when in competitive positions it is grazed severely, has been found to be of outstanding value under certain conditions. Experience with lucerne also is suggestive relative to the simplification of pasture mixtures. Lucerne falls off in yield when in competition with plants which make their maximum

growth at a season different from that in which lucerne makes its maximum growth, and eventually such competition may make it inadvisable to persevere with a lucerne area. Again, defoliation of lucerne when the growth is leafy and immature—*i.e.*, appreciably in advance of its flowering—lessens its vigor and yield, and if such defoliation is carried out frequently enough it may be expected eventually to make even a vigorous stand of lucerne valueless. To sum up it is known from extensive field experience that certain plants such as paspalum, subterranean clover, and lucerne under certain circumstances become of outstanding value for special purposes: the circumstances of competition and of time and method of defoliation govern the value of the plants just mentioned. There is much evidence that a similar position holds in respect to pasture plants generally. For instance, work at the Welsh Plant Breeding Station indicated that the previous defoliation of cocksfoot has a very marked effect on its yield: two areas of cocksfoot were cut three times and eleven times respectively in a certain period. In a subsequent specific period the yield of the area cut three times was nearly fourfold that of the area cut eleven times While this may be taken as an extreme result it serves to indicate the substantial bearing of the manner of defoliation upon the yield of cocksfoot. New Zealand work by D. A. Campbell illustrates a similar relation between red clover and the manner of its defoliation. In an area which had been subjected to controlled grazing, red clover occupied from 80 per cent. to 100 per cent. of the ground in the second season, while in a corresponding area which had been subjected to close and continuous grazing the red clover occupied only 15 per cent. of the ground, while weeds and bare ground accounted together for 35 per cent. of the ground. Exact results such as these coupled with analogous results observed on a field scale assist in explaining the origin of the very divergent opinions at times expressed about the value of various pasture species. For instance, some eulogize cocksfoot just as confidently as others condemn it on the basis of the results they have obtained. Actually, under moderate to good fertility, if the grazing is sufficiently lenient, cocksfoot widely will outyield rye-grass, whereas if the grazing is relatively severe and continuous the rye-grass will outyield the cocksfoot. Considerations of this kind indicate that under the methods of grazing which to-day dominate our farming certain valuable plants often are not exploited to the best advantage, and it may be deduced that simpler seed-mixtures at times would enable these plants to be employed with more effect. For instance, the creation of a sward dominated by cocksfoot and red clover—both relatively late in their season of growth—not only contains the promise of a supply of leafy feed when it is specially valuable but also obviates the difficulties associated with the correct management of a sward in which plants of early and of late growth are equally prominent. It has been shown that pasture plants are most susceptible to weakening by overgrazing during the early stage of active growth. If a pasture consists principally of plants which coincide in their season of growth, then these plants can be strengthened substantially by being allowed to grow unchecked by defoliation during the early stage of active growth. In a mixed pasture, however, plants defoliated at the critical time of early active growth suffer more severely than similarly defoliated plants already past the critical stage, but some difficulty arises in the planning of grazing which eliminates the avoidable defoliation of plants at the critical time of early active growth. From this is does not follow necessarily that early and late species in the one sward should not be sought, for considerations other than ease of grazing management call for attention; but it is clear that the occurrence of early and late plants in the one sward involves certain disadvantages, and the question arises whether suitable simplification of seed mixtures should not be resorted to under certain circumstances to obviate these disadvantages. Such a line of thought diverges sharply from the thought upon which was based the Clifton Park type of mixtures. The wide range

of plants included in these mixtures arises to some extent at least from limitations in the available knowledge. In endeavouring to ensure the presence of all necessary ingredients, ones which are unnecessary and which can be omitted without harm are included. In the light of present knowledge the Clifton Park type mixture is now deemed out of date and unnecessarily costly, but exactly how far along the path of simplification of mixtures it is economical to go has not been established.

Need of adapting Mixtures to Management.

In last month's notes reference was made to the role of top-dressing in determining the composition of pasture seed-mixtures for use in regions of satisfactory rainfall—say, 30 in. or more—and herein some indication has been given that the time and method of grazing and mowing play a part in determining what is the most suitable composition of a sward. In short, the management to which a pasture is to be subjected is often a much more important matter in drawing up a pasture seed-mixture than is the type of soil on which the seed is to be sown. This being so, it is not altogether reasonable to expect maximum success for pasture seed-mixtures which have not been based upon specific planning and study of local conditions. Guidance relative to the constitution of individual seed-mixtures may be obtained from district officers of the Fields Division who have the required knowledge of local conditions.

Economical Purchase of Pasture Seed.

At the time of writing, the number of samples of seed of the current season which have been tested is not great enough to indicate definitely the standard of the whole new crop, but the promise is that generally the germination capacity of the seed will be unusually high. However, as is customary, occasional lines which fall considerably below the general level illustrate the advisability of purchasing on the basis of guaranteed germination and purity so as to avoid being supplied with one of the low-testing lines at substantially the same cost as a high-testing one. In view of the facility with which seed of low germination seems to be sold, it appears to be worth mentioning that while examination by eye may enable the purity of seed to be gauged satisfactorily it is quite unreliable as a means of assessing the germination capacity of seed

That the advisability of using suitable strains of some of the more important pasture plants is being popularly realized is due to the extensive field evidence of the superiority of these strains in the conditions for which they are designed and is indicated by the growing use of certified seed which is the only means of assuring a supply of the superior seed which is desired. One result of the increased attention being given to certified seed is that at times uncertified seed is being offered as "just as good as certified." While in some instances such seed may warrant this claim the odds are that it does not: it is surely reasonable to expect that growers producing seed eligible for certification will take the necessary simple inexpensive steps to bring it under certification and thereby obtain the enhanced returns which certification begets. At any rate, usually it is difficult if not impossible for the purchaser of such seed to assure himself of the real worth of seed not bought under certification. On the other hand, provided certified seed is bought with due attention to its purity and germination, there is assurance that the seed possesses a superiority in certain valuable characters which is not likely to be possessed by any line of uncertified seed of the same species. It seems sometimes to be overlooked that germination capacity is not one of the factors determining certification, and that the germination of various lines of the same kind of certified seed may vary greatly. And while certain restrictions relative to purity attach to certification, certified seed may vary materially in its purity within these restrictions. Because of these facts it is just as advisable to buy certified seed as other seed under guarantees of germination and purity.

Further information about pasture establishment and about the detailed composition of seed-mixtures appears in this *Journal*, February and August, 1934.

Surveying of Future Feed-supplies.

Especially in an unfavourable season such as this is in many localities it is often useful at this stage in the year's work to consider the future position in respect to feed. At times, because of the abnormally dry conditions, inroads have already been made in the supplies of silage originally intended for consumption principally in winter and spring. Further, it seems likely that the pastures will enter the period of low rate of growth in a barer condition than normally, and reserves of supplementary fodder crop promise to be lighter than usual. As, commonly, the reserves of winter and spring feed are undesirably scant, the promise is that a normally unsatisfactory feed position will be worse than usual unless suitable steps are taken to augment the prospective supplies of feed.

Of the measures which may be adopted to improve the position, late summer or early autumn top-dressing with phosphates, especially superphosphate, and, in suitable districts, basic slag, well deserve pride of place under the conditions of rainfall and warmth that are associated with successful autumn response by grassland to these fertilizers. Quite an important feature of February to April top-dressing is that it usually brings about a substantial increase in valuable growth prior to the practically dormant winter period. If the top-dressing is sufficiently early this increase may be especially valuable this year in maintaining dairy production towards the end of the producing-season. In the view of the prospective scant supplies of winter feed any additional growth of grassland in April and May will be particularly useful this year as an aid towards securing good condition in the stock prior to entering upon the relatively severe season of the year

In cases in which limitation in the amount of top-dressing that is practicable necessitates the exclusion of some pastures on a farm from the autumn top-dressing programme, then two classes of pastures should be given priority in attention. Firstly, the better-class pastures, such as those relatively rich in vigorous rye-grass, cocksfoot, and clover should be top-dressed in preference to inferior ones. Though, comparatively, the response from good and from poor pastures may be equal the former normally have capacity for greater net or absolute response to top-dressing. For instance, a 20-per-cent. increase in a pasture of four sheep an acre carrying capacity is in terms of net feed units just double a 20-per-cent. increase in a pasture of two sheep an acre carrying capacity. Secondly, young pastures should as a rule be selected for attention in a restricted top-dressing programme in preference to older and possibly worn ones, and this because it is more economical generally to take proper care of young pastures and thereby to maintain them at the highest possible standard than later to have to undertake the task of repairing or renewing them.

The suitable growing of forage crops sown in late summer or early autumn may also assist usefully in providing feed when it is likely to be needed critically later on. Land from which such crops as oats, wheat, maize, millet, soft turnips, or rape have been removed recently, if sown without delay in temporary pasture, oats, or barley, in the manner described in these notes last month, may be expected to be of distinct service in strengthening the feed position. If the land to be sown in such crops is so hard as to make satisfactory skim-ploughing impracticable, then cultivation with disks set with plenty of cut will serve frequently as a satisfactory alternative to the skim-ploughing. In preparing the land for such crops it is not necessary to reduce the surface layer of soil to a fine condition—indeed, at times the occurrence of clods may be an advantage by preventing the caking of the soil that may develop in a surface layer of fine soil as a result of beating rains.

Grass-harrowing as soon as good rains occur is another means at this stage of fostering the production of fresh leafy feed on pastures on which droppings have accumulated during the dry spell. An essential purpose of such harrowing is the distribution of droppings, and this is achieved more effectively by two strokes of the harrows, one at right angles to the other, than by a similar amount of harrowing carried out in any other manner.

Utilization of Crops.

Often during March a cut of hay or green feed is available from areas of lucerne. After such a cut, if weeds are a menace and if dry conditions prevail, it is likely to be advantageous to give the crop a stroke of the tine-harrows or of other harrows fitted with teeth possessing the fine points required to avoid undue injury to the lucerne plants. There is an occasional tendency to look upon cultivation as a routine part of the culture of lucerne. Actually, at times more harm than good has been done to lucerne crops by ill-considered surface-cultivation. Relative to this, before cultivation is begun an attempt should be made to gauge the prospects of materially reducing the invading weeds without at the same time correspondingly injuring the lucerne by cultivation. If the cultivation needed to reduce the weeds satisfactorily has to be so severe that lucerne plants are freely destroyed, then the lucerne area may become so thinned eventually as not to warrant persevering with it. Because of the resultant thinning the use of implements which cut the main roots of lucerne is as a rule inadvisable.

Every year some areas of maize and of millet are allowed to become too woody or are cut down by frosts. Generally it is advisable to utilize them earlier and at times to employ the land thereby made vacant in growing one of the fall-sown forage crops mentioned above Maize or millet that cannot be used effectively as green feed should be conserved as silage, provided the amount available is sufficient to make this worth while, having due regard to the relatively high proportion of waste associated with small quantities of silage.

Autumn Tillage.

Autumn cultivation well warrants widespread attention. Frequently land on which cereals and rape have been grown should be cultivated as soon as practicable after the removal of these crops. Such cultivation tends to weaken or destroy perennial weeds, and to encourage the development and eventual destruction of seedlings of certain annuals. Further the cultivation by improving the fertility of the soil fosters greater rapidity of growth and vigour in crops subsequently sown in the autumn, and thereby incidentally makes such crops able to compete more successfully against annual weeds which germinate in the spring.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Control of Pests and Diseases.

An appreciable rainfall during the month of February or prolonged occurrence of humid conditions increases the danger of a late infection of black-spot, and when these are experienced an application of the usual combination-spray should be made later in the season than is otherwise necessary. This spray applied in early March often prevents serious losses on late varieties such as Dougherty and Sturmer.

Where summer oil has not yet been applied for the control of red-mite, two applications at a dilution of from 1 per cent. to 2 per cent. should be made as soon as possible. An interval of ten days between the applications is desirable. About fourteen days should be allowed to elapse before applying summer oil following a sulphur spray.

At this season late varieties of stone-fruit require spraying, as recommended in these notes for December last, particularly for the control of brown-rot. The frequent gathering and destruction of all diseased fruits, both on the trees and on the ground, will assist very appreciably in the control of this disease.

Handling Fruit for Export.

If the best results are to be obtained, the utmost care and skill is necessary in every operation in which the handling of fruit is involved. Although speed is essential it should not be striven after to the extent that the ultimate out-turn of the fruit will be deleteriously affected. In the packing-shed there should be as much space as possible provided for every operator. Congestion frequently necessitates double-handling of the fruit, which increases costs. Good lighting is also essential for good work, particularly for the graders and packers. Sky-lights are far more satisfactory than any number of side windows, as the latter almost invariably produce shadows which conceal some portion of the fruit that otherwise would be visible to the operator. It is suggested that fully 50 per cent. of the below-standard fruit that is inadvertently included in cases of fruit prepared for export is due to inadequate lighting.

Machine graders will require frequent cleaning to remove accumulations of oily matter which forms into hard lumps, liable to bruise the fruit. The frequent cleaning-out of the bins is important, as also is general care of all moving parts, to ensure good running order. The over-filling of bins is frequently the cause of stem-punctures and bruising. As the case is being packed it is important that the packer should apply pressure with the hands at the ends of the case This practice is necessary to keep the ends low and at the same time permit of a good bulge in the centre of the case. The turning of the fruit in the right direction on the top tier should also be insisted upon. It is a good practice for the person attending to the nailing-down to be in some way held responsible for any damage resulting from that operation. This will, in a large measure, prevent the nailing-down of cases that have not been well packed. Cases packed with the fruit too high at the ends should be specially guarded against as this fault in packing is largely responsible for fruit arriving at its destination in a bruised condition. A badly driven nail often results in trouble ; if projecting inwards a fruit may be punctured ; if outwards possibly an injured hand or a dropped case. Especially in loosely packed cases, care is necessary in operating the lidding press to see that the fruit along the sides and ends are not cut on the edges of the case.

The outward appearance of the cases should be given due attention by using only a good quality paste and the stamping of necessary particulars, such as the variety, in a clear and neat manner. The good reputation New Zealand fruit has gained on overseas markets can be maintained only by strict attention to every detail in connection with the marketing of the fruit.

Tree Supports.

At this time of the year the matter of providing necessary supports for fruiting limbs should receive immediate and constant attention. Neglect of this important work frequently results in the loss of valuable fruiting wood which will take a number of years to replace. Trees supported by a permanent system of wire bracing will at times require further attention by shifting the supports either higher or lower on the limbs, according to requirements, also further limbs may need including in the system. Props frequently require adjustments, especially following a windy period.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

In those districts where exceptionally dry weather has been experienced this summer, growers of citrus fruit will need to keep their land in a constant state of cultivation, so that the surface soil is in as fine a tilth as is possible. Where mulching has been carried out either with rough litter or manure it will have helped to conserve moisture and keep down weed growth In some groves irrigation could be employed with advantage, although as a rule it is not necessary; but it is worth the effort to supply water if by doing so one can save defoliation and loss of the crop.

As soon as autumn rains commence the trees put forth an amount of vigorous growth, and this should be "pinched" and spaced in order that the growth may become reasonably hard to withstand the frosts which may be expected with the coming of the winter.

All fruits should be harvested as they become ready and ripening fruit not allowed to develop on the trees, as this would put an undue tax on them at this period of strain.

Given humid conditions suitable for the spread of verrucosis it will be necessary to apply a further spray of bordeaux 3–4–50 if the advancing crop is to be kept clean.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Culling.

MARCH generally can be regarded as the best time in which to detect and cull the hens not worth keeping for another year. In the work of culling, a good guide in distinguishing the money-makers from the drones, is to observe the time of moulting. It will be found invariably that the hens which moult first are the poor layers and the birds of weakest constitution in the flock, so that second-year hens showing the first sign that their present laying-period is coming to an end should be marketed without delay. This does not apply, however, to noted breeders: these may be kept until they are three or even four years old, providing their constitutional vigour is unimpaired. In culling a flock the wise poultry-keeper does not let sentiment influence him, but always keeps in mind the food-bill, a most important factor in the business. He not only culls all hens that have passed their second season of production, except as before stated in the case of noted breeders, but he also culls heavily the first-season layers. It should be remembered that after the first laying-season, a hen's value as a layer lessens, and after the second year she will usually produce only during the season when eggs are cheap, and thus be unprofitable to keep. Many hens die in debt to their owners because they have been kept beyond their time of usefulness, whereas if they had been culled at the right time they would have shown a good margin of profit over their keep.

When culling on the time of moulting, individual conditions should always be kept in mind, especially in regard to the time the birds were hatched out, for it is obvious that the very early hatched bird will moult in advance of one brought out on the late side. Another point that may be mentioned is that the older birds in a mixed flock of first- and second-season layers, where the latter were selected the previous season for the reason that they were late moulters, will usually, owing to their shorter season of production, moult later than the pullets which commenced to lay, say, some time in April, so that in such cases where the moulting period is taken as a guide, due allowance for the age of the birds must be made when culling. Otherwise many of the young birds which it would be profitable to keep are apt to be disposed of, and older but less profitable ones retained on the plant. On all well-managed plants a mark or ring is

placed on every bird as an indication of age, by which the old birds can be distinguished readily from the young ones, and this obviously simplifies the work of classifying the stock.

Apart from late moulting, there are other signs indicating that a hen is going to take a long period of rest, such as a loss of bloom and shrinkage of the comb, and also a shrinkage about the abdominal region, until the breast-bone comes into close contact with the pelvic bones. The latter also contract until the width between them does not admit more than one finger. In the case of yellow-legged breeds such as Leghorns, the paleness or otherwise of the shanks and beak at this time of the year affords a guide for distinguishing the heavy layers from the drones. With the heavy layer both the shanks and beak will have a well-bleached and almost white appearance, while those of the drones will be a rich yellow. It must be remembered that this applies only towards the end of a laying-season, as even with the best layers in the flock the shanks and beak will regain a rich colour after they have gone through the moulting process. Especially does this apply where the birds are running on damp land or well-grassed runs. Of course, during the pullet stage all birds of the yellow-skinned breeds should have yellow shanks, as any other colour indicates that they are not standard-bred.

Another point which serves as a good guide to a bird's productive power is that the heavy layers at this period of the year will present a more or less shabby appearance, and, owing to this fact, are often the first to be culled out by the inexperienced poultry-keeper. With the exceptionally heavy layer it is not uncommon for the plumage to present an unkempt appearance. This particularly applies to the tail feathers which become more or less broken and worn down as a result of frequently visiting the nest, while the head becomes almost completely devoid of feathers, a sign seldom or never found in a low egg producer.

Generally the best layers are the thinnest birds in the flock, whereas the heaviest and best-looking are the drones. Especially does this apply to the former when the food is not supplied with a free hand. The condition of the skin surrounding the abdominal region also gives a guide to laying-power. This skin should be soft and flexible to the touch, so as to allow for contraction and expansion in accordance with the bird's laying condition. Beware of the bird that is hard and coarse to the touch around the abdominal region, as this indicates that it is converting its food into fat and flesh instead of eggs.

Summarizing the foregoing points, the birds that it usually pays to cull are those that show signs of early moulting, those with well-kept plumage and which are above the normal weight of their breed, those with hard development surrounding the abdomen, and those with points indicating a weak constitution, such as dull sunken eyes, heavy well-feathered eye-brows, bright yellow legs, loose feathering, and sluggish appearance.

When to Market.

Do not delay marketing the culls until the moult has practically set in, or until they have practically got over it They should be marketed immediately they commence to take their rest prior to going into a moult. With the hens which show signs of being in a laying condition, and which it is intended to cull when they reach the moulting-period, forcing for egg-production is desirable in order to get all possible eggs from them in the time available. There should be no sentiment in this matter. Even if an odd bird should show the effects of the forcing condition, in the way of ovarian disorders, such as protrusion of the oviduct, it will pay to destroy it rather than retard the laying of the others. On the other hand, the birds which have been selected for next season's breeding-pens should not be forced, nor should there be any endeavour to make high egg-yields. Such birds should be kept in a healthy vigorous state, which is not encouraged by being subjected to forced

feeding for egg-production. It has to be remembered that they have the moult to go through, which is in itself a considerable strain on the constitution. This loss must be made good before the breeding-season, for if the birds are to leave vigorous progeny they must have the necessary vitality inseparable from good health before being placed in the breeding-pen.

Lameness in Young Ducklings.

Several complaints have been received lately regarding lameness and loss of leg-power in ducklings that were being reared by artificial means. This may be due to having the drinking-vessels insufficiently deep to allow the birds to get their heads well under the water for keeping their nostrils from becoming clogged up with food, &c. Another, and most common cause, is dampness in the sleeping-quarters, and allowing the ducklings to sleep on wet bedding material. Curing this trouble is out of the question, and the only safe course is to prevent it. The first step in this direction is to provide drinking-vessels which will allow the young birds to get their heads sufficiently deep under the water to give their nostrils a vigorous "blow out." Care must also be taken to keep the bedding material in a dry state, and with this in view the drinking-vessels should be placed well away from the sleeping-compartment. This will go a long way to prevent the droppings from the birds after drinking coming into contact with the bedding.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Final Extracting.

Before taking the last of the surplus honey a careful examination of the colonies should be made in order to ascertain the amount of stores available for wintering the bees. Too often beekeepers err in extracting too closely, and feeding has to be resorted to at a later period to make up the amount required to prevent starvation. It takes 30 lb. of honey to winter a colony successfully, and if this amount is increased to 40 lb there is less likelihood of the bees being short in the spring, while the beekeeper will be saved a great deal of anxiety and endless trouble in the way of feeding.

Where extracting has been delayed for any reason it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care must be exercised not to incite the bees to rob by keeping the hives open longer than it is necessary to remove the surplus. A rapid examination of the brood-chamber should be made in case it is found that the bees have not filled the combs in the lower story with honey. If empty or partly filled combs are found, it is highly important that they be replaced with good combs of honey from the super. On no account should an attempt be made to extract any honey from the brood-chamber. It is inadvisable to leave combs lying about or to expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to start the bees robbing in a wholesale manner.

Extracted Combs.

It is very bad practice to put extracted combs on the hives as soon as the honey is taken from them. If returned during the day in all likelihood robbing may be started, and, moreover, the bees will become troublesome as they seek an entrance to the honey-house. The wet combs should be placed on the hives in the evenings, as the bees will have time to clean them during the night, and any excitement caused by the return of the combs will have subsided by morning. Owing to the labour involved in carrying

out supers of combs, placing them on the hives, then freeing the combs of bees, and finally returning them to the honey-house, many beekeepers make a practice of storing wet combs. Although no definite research work has yet been undertaken to determine whether the following season's honey is affected by combs stored in this manner, it seems very doubtful whether the storing of wet combs is advisable—the moist atmospheric conditions promote fermentation of the honey in the combs, and in the course of time honey-houses become permeated with the injurious bacteria of fermentation, while the sour smell engendered cannot be considered otherwise than as detrimental to the keeping-qualities of a well-ripened honey.

It may be well to remind beekeepers that many lines of honey, while not actually sour or in a fermented condition, possess the characteristic odour so very noticeable in rooms used for storing wet extracting combs. The keeping-qualities of such honey are regarded as doubtful, and it is rejected for export. While beekeepers may be producing the maximum crops attainable under the season's conditions, the after-care of the honey, once it is in the storage-tanks, presents quite a number of problems, not the least important of which is the preservation of its natural aroma.

Bee-escapes.

For removing honey late in the season the beekeeper may find it necessary to bring into use bee-escapes. These escapes enable the honey to be removed without causing any disturbance. By the employment of the Porter bee-escapes there is less likelihood of causing robbing, with its attendant evils. More especially will the escapes be found advantageous when removing section honey from the hive. There is far more risk in removing comb honey from the hive than extracted honey. When the colony is disturbed the bees will at once start to fill their sacs, and often the cappings of the sections are punctured in order to secure a supply of honey. The damage to the cappings of sections is unsightly and causes the honey to leak after removal from the hive.

The best escape device is made in the form of a frame 20 in. long by 15 in. wide by 3 in. deep, which is covered by wire gauze, and one or two escapes fitted into it. In inserting the escape gently prize up the super from the brood-chamber and insert the board. A puff of smoke will suffice to control the bees whilst the operation is being performed. If this is done late in the afternoon the bees will pass through the escape during the night to the brood-nest, and will be unable to return. In the morning the supers may be removed, when practically no bees will be left in them.

A word of caution to those who have not formerly used the escapes: Should there be brood in the super combs the bees will not leave, and the escapes will not prove effective in ridding the supers. Over and over again many beginners complain that they cannot get the bees to leave the supers when using escapes; but the reason lies in the fact that no examination had been made to ascertain beforehand whether the super contained honey only.

Uniting Colonies.

In the autumn work requiring attention is the examination of the colonies for the purpose of ascertaining if each possesses a laying queen, and of noting those that are too weak to survive the winter. In the negative in either case it is advisable to unite the colony with a stronger one to save the bees. On no account should an attempt be made to winter weak hives, as they are likely to get robbed out, and this may cause the bees to start robbing generally when everything in the apiary should be quiet.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

THE full enjoyment and economical use of many vegetable crops does not depend only on a wise selection of varieties and careful culture: similar consideration must be given to harvesting and storage if there is to be no loss in quantity and quality and the stocks are to be available over a maximum period. Under our conditions celery, parsnips, salsify, artichokes, autumn-sown carrots, and beet may be left in the ground and lifted as required with satisfactory results until about the month of August, when growth is about to recommence. They must then be lifted and stored where the conditions are cold, well ventilated, and not too dry. Main-crop carrots, maturing about the month of April, will split if left in the ground, and become coarse and fibrous, as will main-crop beet maturing at that time. These should be lifted in fine weather as soon as they mature and given the storage conditions mentioned above.

A lean-to shed with a southerly aspect is often a suitable place, especially when shaded by plantation trees. Such a place is also suitable for potatoes, stored in bins, sacks, or boxes, if it is clean and well drained, but not so dry as to cause the tubers to shrivel. There will be losses from decay if the stocks are contaminated by the presence of decayed tubers or waste carried over from a previous season in the store or its vicinity. This can be avoided by the methodical disposal of decayed waste at all times, and an annual clean-up which may very well include a through spraying of the interior of the store with a reliable fungicide. Losses from decay may also occur through infection caused by decayed tubers overlooked when bagging up in the field. Doubtful stocks should be picked over after a month or two in storage, and if the infection is fairly extensive they should be used up as soon as possible. Large quantities stacked in a compact manner will heat and sprout, especially in warm districts and in a store where attention to ventilation is neglected. In such localities they may be stored satisfactorily in slatted bins to a depth not exceeding 3 ft. or 4 ft., but in colder districts 6 ft. may be a maximum depth Where stocks are large and storage accommodation limited a quantity for late use may be pitted if the tubers are quite sound. For this purpose a well-drained cool position should be chosen and the pit made not more than from 5 ft. to 6 ft. wide and the tubers piled as high as possible. If these conditions are observed and the potato crop is dug carefully in fine weather so soon as it is ripe, and allowed to harden off for a few hours before gathering, it will be used to best advantage.

Onions should be lifted as soon as they are ripe and placed in windrows, consisting of five or six rows of onions, until the tops wither completely. If humid weather is experienced the windrows should be turned over; for this purpose a wooden rake is suitable. When thoroughly dry the tops should be trimmed off with shears and the bulbs bagged up or placed in slatted crates and stacked in an open shed for a few weeks to cure thoroughly before storage or shipping. When cured the bulbs should be cleaned by the removal of the dry outer scales, thick necks, and decayed or injured bulbs, and graded to size. They will then store satisfactorily if placed in a dry atmosphere that is cool, with an even temperature, and given thorough ventilation at all times except in wet or humid weather. If stored in slatted boxes they are stacked, like fruit, with a 1 in. space between tiers and rows to permit of the circulation of the air. Or they may be spread 6 in. or 8 in. deep on slatted shelves. Or small quantities may be "strung" and hung in a dry airy place in the old-fashioned manner. The bulbs quickly deteriorate in a close atmosphere.

Vegetable marrows are best used in a green state when of a suitable size, but pumpkins, and what are known in America as winter squash—such as the Hubbard varieties—should be harvested not until thoroughly ripe

but before they have been frosted. They should be cut with a portion of the stem attached to the fruit and left in the field to mature before carting. They must then be handled and carted with care, as they are easily injured seriously at this stage. Stored in a warm, dry, airy place for a few weeks the shells harden up and they will then stand somewhat lower temperatures and rougher handling if that is necessary.

In the warmer districts, especially where there is a heavy rainfall, the ordinary late potato crop is rather difficult; but the sweet potato or kumara generally grows well. For this and other reasons it is increasing in popularity in such areas. While the crop is best left growing as late as possible, it must be lifted before there is any frost or the tubers immediately under the crown are liable to injury. If frost kills the vines the kumaras should be dug immediately as decay sets in on the dead vines and may pass down to the roots. Digging must be done with the greatest care as the slightest damage at this stage prevents the tubers keeping. Storage losses are chiefly due to faulty handling before curing. The last-mentioned operation is usually done by gathering the kumaras into heaps and covering them with sacks every night, to dry them thoroughly before storage in a warm dry chamber that can be ventilated in warm weather. Small quantities may be successfully kept by storing in sand so long as it is perfectly dry. In the southern states of America, where they are grown on a commercial scale, the roots are stored in crates, stacked to allow the air to circulate through them, in chambers that are heated to a temperature of about 80° F. for the first fortnight or so of the storage period. When the roots are well dried off the temperature is allowed to drop to 55° F. and held there for the rest of the storage period, giving ventilation freely when the weather permits. In this way, with dry beans, pickles, and chutneys, the garden makes valuable contributions to the larder during the winter as well as the summer months.

Among the young growing crops hoeing in fine weather will be required to keep down weeds It is advisable also to select a piece of well-drained ground and prepare it, as soon as it is available for planting out spring cabbage during the month of April. It is timely to earth up celery in fine weather and sow spinach, lettuce, and onions. In the more humid districts this onion crop is of first importance; by planting out the seedlings in the month of July, or so soon after as the land may be got into condition, the crop ripens in the dry summer weather and is harvested under the best conditions. Rocca and Tripoli types are not the best onions for long distance shipping, but their tender mild qualities create a good local demand.

The Tomato Crop.

Where the tomato is one of considerable importance it will sometimes be advisable to select the seed under local conditions, so that it is not only of a type suited to one's requirements but also thoroughly acclimatized. Time and careful consideration should be given to the selection of plants from which seed is to be taken: they should be free from disease, of good constitution, and carrying crops that are as satisfactory as possible as regards quantity and quality. It is advisable to remove fruit that is likely to be coarse or small and allow the remainder to ripen naturally on the plants which should be flagged to enable them to be readily recognized. When ripe, cut the fruit open and drop the pulp into a little water. Stand it in a warm place and as soon as it commences to ferment pour it into a sieve or gravy-strainer and wash it well under a tap of running water until the clean seed only remains Place it in a position where it will dry quickly and stir it well frequently to prevent the seeds sticking together. If the seed is stored in tins or other air-tight containers it is as well to dry it a second time after a short period, to make sure it is quite dry. It should then remain in good condition for five years at least. Another method is to scoop the seeds from the fruit and let it drop on to sand that is quite dry and has been passed through a fine sieve: rub the mixture well through the hands for some time and then spread it to dry. When dry rub it again and sieve it to remove the sand.

Sundry Fruits and Nuts.

Where plants of this kind are to be set out during the planting-season—May to September inclusive—and while the land is being prepared, details of the planting plans should be decided, and healthy plants of good moderate growth and the required varieties should be selected and ordered for delivery in the month of May, which is about as soon as they will be available. Heeled in in friable soil they will then be quite safe for four or five months, if necessary, and ready for planting out at any time.

Plants of this class include the well-known bush fruits such as gooseberry, currants (black and red), raspberry, loganberry, passion-fruit, Chinese gooseberry (*Actinidia chinensis*), Cape gooseberry, tree tomato (*Cyphomandra betacca*), loquat, avocado (*Persea gratissima*), olive, fig, pomegranate, guava, and feijoa (*Feijoa sellowiana*). The nuts which are grown here most satisfactorily are walnuts and almonds, chestnuts and hazels; also pinea nuts, as the seeds of the stone pine (*Pinus pinca*) are sometimes called. The first three—gooseberries currants, and raspberries, thrive best in the colder districts. Walnuts and almonds should be planted extensively only in the dry localities, and all may be planted out at any time during the planting season except loganberries, passion vines, Cape gooseberries, and tree tomatoes, which are usually planted in the springtime. Shelter is a feature which demands careful consideration where large plantations of bush fruits are grown adequate shelter is a necessity and nothing is better than well-grown hedges and plantations

During the first season some inter-cropping with vegetables may be done, so long as first consideration is given to the welfare of the permanent crops.

The Homestead Garden.

Where new gardens are being made the preparation of the land for setting out plantations, shrubberies, and herbaceous borders is now being done. For large plantations on flat land it is a great advantage if the grassland is well broken in by skimming and double ploughing before the trees are planted. For shrubberies and herbaceous borders the ground is trenched, and, for the latter especially, a generous dressing of farm manure is worked in. If this work is done thoroughly and all bad perennial weeds are quite eradicated there will be no doubt about obtaining good results if a suitable selection of trees and shrubs is planted and they are arranged effectively. The last two points require much time and study, but the comparatively permanent nature of the work makes it advisable to give it every consideration.

In established gardens it is well to remember that spring flowering bulbs should be planted now: they are planted at any time during the first four months of the new year, but the earlier the better, so that they may be well rooted before any top growth is made.

There are few established gardens that cannot be improved by a little rearrangement and addition to the shrubberies and isolated specimen trees. Many subjects such as tree ferns, palms, and clematis cannot be planted satisfactorily until adequate shade and shelter is established. The planting season affords the necessary opportunity for carrying out these alterations, and in the meantime the necessary consideration may be given to the work so that it may be done to best advantage. Plants that have been unsuitably placed can often be removed and planted where they will give better service, while successful planting can often be supplemented to give a greatly improved appearance. Hydrangeas in rather shaded positions have done well this season, and maintained a display of bloom when the rhododendrons had finished. In turn they are being succeeded by that Japanese lily known as *Lilium speciosum*, red and white, which delights in such an association under those conditions.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PAINT FOR FARM BUILDINGS AND EQUIPMENT.

W. T. B., Papakura :—

As paint for farm buildings (wood with iron roofs), farm-gates, &c., would powder red oxide mixed with boiled linseed oil serve suitably ? If so, what amounts of materials should be used ?

The Public Works Department :—

Powder red oxide, mixed with boiled linseed oil, would answer the purpose ; and if you decide to use this, the proportions are easy to remember. For each pound of oil use 1 lb. of powder red oxide, but it would be advisable to use sufficient oil with the red oxide to form a paste ; and after thoroughly mixing leave it for a month before adding the balance of the oil It is considered preferable to use red oxide ground in oil to mix with linseed oil, as you will get a superior product from machine mixing to that done by hand. This is a matter entirely for your decision, but the following figures may help you to decide. Linseed-oil 5 gallons, weight 47 lb, costing approximately 4s. 6d. per gallon, equals £1 2s. 0d. ; powder red oxide 47 lb., costing 3d. per pound, 11s 9d. : total, £1 14s. 3d. This would give, approximately, 5¾ gallons of paint, costing about 5s. 10d. per gallon Linseed-oil 2½ gallons, weight 23½ lb, costing approximately 4s. 6d per gallon, equals 11s. 3d ; 72 lb. of red oxide in oil, costing approximately 5d. per pound, equals £1 10s. : total, £2 1s. 3d. This would give you 6½ gallons of paint, costing approximately 6s. 4d. per gallon. Paints suitable for this class of work are also put up by paint-manufacturers, and if your requirements are small, this is the most satisfactory way to buy, providing you purchase goods made by a reputable firm. It would be wise to check up the local costs of articles mentioned before reaching a decision.

METHOD OF KILLING TREES.

R. T. C., Hinakura, Martinborough :—

I seek an effective way to kill the ordinary blue-gum trees which were cut down last winter to a few feet off the ground. They are now making growth again profusely I bored into the centre with a 2 in. auger and poured salt in, and also a solution containing arsenic, but without success.

The Horticulture Division :—

The attempt to kill the blue-gum tree was unsuccessful probably because the liquid agent was placed in the centre of the stump. The vital formative tissue is just beneath the bark of the tree, and the arsenic solution, or whatever may be used, should be placed in the sap wood so that it may readily act upon that tissue to destroy it.

PROVISION OF NESTS FOR HENS.

Novice, Tinwald :—

How many nests are required for 100 hens, each nest to be large enough to take two hens at the same time ?

The Live-stock Division :—

From twelve to fifteen nest-boxes sufficiently large to accommodate two hens in each would be sufficient for 100 hens.

WEATHER RECORDS: JANUARY, 1935.

Dominion Meteorological Office.

NOTES FOR JANUARY.

THE present summer bids fair to be the hottest every experienced in the Dominion. Though not quite so much above normal as December, mean temperatures in January were very high. Rainfall was again much below average over a large part of the country, and, though many drier Januarys have been experienced, the continued rain-shortage, combined with the very high temperatures, has resulted in serious conditions for the farmer in most of the more thickly settled districts Pastures are, in general, burnt up, and in many places there is a shortage of water. The milk yield has fallen off very greatly, and stock are beginning to lose condition. Cereal crops will be light and the grain in many cases shrivelled. Many of the crops were late-sown, and the dry weather has been more severe on them than would otherwise have been the case. The prospects for fodder crops are not good. Insect pests are rather troublesome in some districts. Nelson, Westland, parts of Otago and Southland, and some of the high country of the North Island, are in much better condition than the rest of the Dominion, but for the country as a whole the position is a serious one and rain is very badly needed.

Rainfall.—Heavy rains were recorded in the western half of the South Island. Parts of eastern Otago and south Canterbury and of the high country in Taranaki and Wellington also fared well. Elsewhere the month was a very dry one. The position is most acute in the Waikato, Bay of Plenty, and east coast districts of the North Island and most of Canterbury and Marlborough.

Temperatures were everywhere considerably above the normal. In some parts, January, 1887, was hotter, but for the Dominion as a whole last month was probably the hottest January hitherto experienced. In the North Island the departures from average were everywhere large, but in the South conditions were less uniform. There were not many high-temperature records broken, but it was almost continuously warm, and many readings above 90 degrees were registered.

Sunshine.—South of Nelson and Marlborough the amount of sunshine recorded did not, as a rule, differ greatly from the average for January, but elsewhere the month was a very sunny one. Tauranga reports 327·6 hours, Blenheim 299·1, and Napier 293·9.

Storm Systems.—Typical summer weather conditions prevailed throughout the month. Numerous depressions travelled across the Tasman Sea and New Zealand, but generally they were quickly moving, shallow, and of complicated form. As in the previous two months, they were much less vigorous over New Zealand than over Australia, and none of them produced a really good general rain. Again, also, there was an absence of strong outbreaks of cold air from the south, although Australia experienced a number. Disturbed weather prevailed, also, in the Pacific Island group. There was a considerable amount of westerly wind, especially over the South Island, and consequently frequent heavy rains occurred on the west coast and in the ranges of the South Island. Some of these extended to the high country in Wellington and Taranaki. Such rains occurred from the 7th to 9th, on the 25th and 26th, and on the 28th and 29th.

Between the 1st and 3rd, two depressions following closely on one another brought widespread rains, with heavy falls in many places. This was the wettest period of the month.

Again, between the 17th and the 22nd, a depression which, though shallow, was of a shape more favourable for rain than most of the remainder, and which was followed by a fairly strong southerly, was responsible for almost general falls. Unfortunately, however, they were in many cases only light.

RAINFALLS FOR JANUARY, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	1·80	6	1·08	3·94	1·80	3·94
Russell	1·80	8	0·64	3·25	1·80	3·25
Whangarei	3·93	9	2·91	3·93	3·93	3·93
Auckland	2·24	6	1·74	2·72	2·24	2·72
Hamilton	1·20	7	0·38	3·57	1·20	3·57
Rotorua	1·84	6	0·91	4·26	1·84	4·26
Kawhia	1·84	6	0·82	3·55	1·84	3·55
New Plymouth ..	4·61	11	1·70	4·19	4·61	4·19
Riversdale, Inglewood ..	8·56	14	3·21	7·51	8·56	7·51
Whangamomona ..	11·71	9	4·11	5·58	11·71	5·58
Hawera	2·24	10	0·51	3·51	2·24	3·51
Tairua	1·39	3	0·73	3·66	1·39	3·66
Tauranga	0·96	7	0·63	4·08	0·96	4·08
Maraehako Station, Opotiki	2·75	5	1·16	3·59	2·75	3·59
Gisborne	1·12	5	0·70	2·72	1·12	2·72
Taupo	1·38	7	0·44	3·37	1·38	3·37
Napier	0·41	6	0·11	2·93	0·41	2·93
Hastings	0·48	6	0·19	1·93	0·48	1·93
Whakarara Station ..	1·57	7	0·86	..	1·57	..
Taihape	2·66	9	0·72	3·20	2·66	3·20
Masterton	0·80	6	0·52	2·60	0·80	2·60
Patea	2·54	10	0·92	3·59	2·54	3·59
Wanganui	2·67	5	1·39	2·83	2·67	2·83
Foxton	1·70	9	0·70	2·14	1·70	2·14
Wellington	1·87	9	0·66	2·81	1·87	2·81
South Island.						
Westport	11·57	20	2·03	8·20	11·57	8·20
Greymouth	14·35	21	2·66	9·17	14·36	9·17
Hokitika	16·49	22	3·73	10·07	16·49	10·07
Ross	15·21	17	2·58	12·40	15·21	12·40
Arthur's Pass ..	20·30	19	4·30	14·12	20·30	14·12
Okuru, South Westland	22·45	12	5·00	12·59	22·45	12·59
Collingwood	6·05	12	1·67	6·71	6·05	6·71
Nelson	3·27	9	1·18	2·81	3·27	2·81
Spring Creek, Blenheim	1·13	9	0·25	2·22	1·13	2·22
Seddon	1·25	6	0·45	1·84	1·25	1·84
Hanmer Springs ..	2·04	11	0·48	3·90	2·04	3·90
Highfield, Waiau ..	0·79	8	0·22	2·98	0·79	2·98
Gore Bay	..	..	..	2·46	..	2·46
Christchurch	0·77	10	0·38	2·18	0·77	2·18
Timaru	2·31	11	0·70	2·27	2·31	2·27
Lambrook Station, Fairlie	..	..	..	2·43	..	2·43
Benmore Station, Clearburn	1·88	14	0·53	2·77	1·88	2·77
Oamaru	1·53	15	0·60	2·04	1·53	2·04
Queenstown	4·35	15	0·86	2·92	4·35	2·92
Clyde	1·94	12	0·77	1·85	1·94	1·85
Dunedin	3·04	15	0·83	3·43	3·04	3·43
Wendon	4·23	16	0·80	3·20	4·23	3·20
Balclutha	4·04	15	0·75	2·31	4·04	2·31
Invercargill	7·19	20	1·05	4·01	7·19	4·01
Puysegur Point ..	14·89	23	2·10	7·62	14·89	7·62
Half-moon Bay ..	8·09	21	1·27	4·82	8·09	4·82

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THE HYGIENIC PRODUCTION OF MILK ON THE FARM.

A REVIEW OF THE ADMINISTRATION BY THE LIVE-STOCK DIVISION OF THE REGULATIONS UNDER THE DAIRY INDUSTRY ACT, 1908, REFERRING TO THE REGISTRATION AND INSPECTION OF DAIRIES PRODUCING MILK FOR SALE.*

W. C BARRY, Director, Live-stock Division, Department of Agriculture, Wellington.

IN New Zealand the legal authority to sell milk to the public is that granted by the Department of Agriculture, in accordance with the provisions of the Dairy Industry Act, 1908, and regulations made thereunder. Registration is effected by the Live-stock Division of the Department, the officers of which Division are entrusted with the duties of dairy inspection.

It is quite unnecessary to stress the well-recognized importance of and responsibility attached to the work of supervising the production of the public milk-supply. This responsibility, in so far as the Department of Agriculture is concerned, ends when the milk leaves the farm-gate. It includes, however, supervision of the entire process of the handling of milk on the farm, from the milking of the cow until the milk leaves the farm for distribution to the public.

The purity of the public milk-supply is a subject which of recent years is receiving increased attention in all countries. This development is particularly noticeable in England, where a complete revision is taking place in the attitude towards the sanitary control of milk. This might be said to have commenced with the introduction in 1923 of the Milk (Special Designations) Order, which prescribed the conditions under which graded milk might be sold in England. The amount of milk produced under the licensing system in England to-day is but a fraction of the whole; the volume is, however, increasing, and it is anticipated that in time it will amount to an appreciable proportion of the whole milk-supply of that country, in spite of the fact that the cost of production is thrown upon the farmer, and that the production of such milk does not always meet with the support that might be anticipated.

* Read before a meeting of the Royal Sanitary Institute at Wellington, on the 30th January, 1935.

In New Zealand the work of dairy inspection is carried out in their respective districts by stock inspectors. In the four large centres a veterinarian supervises the work, and carries out tuberculin testing of cows, &c. In some of the smaller municipalities where a departmental veterinarian is stationed, the duty of dairy inspection is entrusted to that officer.

It is gratifying to note that the subject of the purity of the milk-supply has of late years engaged greater attention from the public, and also local bodies. Such manifestations are of considerable value to those entrusted with the administration of the regulations, and offer distinct encouragement to the producer to raise the hygienic standard of production. The value of competition in this respect is readily observed. If, in any group of dairies supplying milk to a centre, certain dairymen establish a higher standard in production generally, the result usually is that others are forced, from a competitive point of view, to do likewise.

Owing to the climatic conditions of New Zealand allowing of the pasturing of dairy herds throughout the year, we are, in this country, in the fortunate position of having the cow-shed representing only what is practically standing accommodation for the cows during the milking process. It can be understood readily what a difference this makes in the sanitation of the shed when compared with those places in which cows are housed for a period each winter.

There follows an endeavour to summarize the essential details of farm dairy inspection involved in the direction of the production of a pure milk-supply. The first consideration, before any reference is made to the dairy premises, is the health of the cows.

The Health of the Dairy Herd.

In this connection, the diseases of cattle recognized as transmissible to man through milk are tuberculosis, *Brucella abortus* infection, cow-pox, foot-and-mouth disease. In this country we are concerned only with the first three.

Regular inspections of the cows in registered dairies, for the detection of tuberculous animals, are made by departmental veterinarians and stock inspectors. Clinically affected animals are condemned under the provisions of the Stock Act. Suspicious animals are subjected to the tuberculin test and reactors removed. Any dairyman wishing to have all his cows tested can have this done, free of charge, by the Department, and this practice now obtains to a certain extent in many centres. The tuberculin testing of all cows supplying milk for human consumption is not, however, compulsory. In the elimination of tuberculous cows from the milk-supply, advantage is taken of the biological test which is carried out at the Wallaceville Veterinary Laboratory. In this test composite milk samples from the entire herd are forwarded to the laboratory for guinea-pig inoculation. In the event of a positive reaction occurring, all the cows in the herd are subjected to the tuberculin test, and reactors removed, careful *post mortems* being conducted. During the year ended 31st March, 1934, five hundred and eighty-seven such samples were dealt with, of which eleven (1·87 per cent.) proved to be positive.

Brucella abortus infection in milk is now known to give rise to the condition termed undulant fever in the human being. Abortion infection in cows is very widespread, as is shown by the large number of cows which react positively to the agglutination test. Fortunately, however, infection in milk is not so common. In recorded cases of undulant fever in human beings, the Department of Agriculture co-operates with the Health Department in an endeavour to trace a source of infection in the milk-supply. It is, of course, not suggested that all cases of undulant fever are caused through infected milk, as it is well known that infection can occur through avenues other than by ingestion of milk.

Milk from cows suffering from cow-pox should not be used for human food. This requirement is covered by the regulations.

Diseases of Cattle which may render Milk harmful to Man.

Mastitis.—In other countries epidemics of septic sore throat have been recorded in which the infection was transmitted by milk. In some of these epidemics cows affected with streptococcic mastitis were declared to be the source of the infection, but in other outbreaks the circumstances seemed to point to the infection of the milk by dairy workers. It is generally accepted that the *Streptococcus mastitidis* which causes mastitis in cows is non-pathogenic to man. In routine dairy inspection cows which are found affected with mastitis are excluded from the milk-supply.

Septic Metritis.—Cows affected with this condition should not be allowed in the milking-shed. Similar precautions are taken in cases of cows with retained placental membranes.

Other Diseases.—Any disease of the dairy cow attended with a considerable disturbance of the general condition usually causes a decrease or a complete cessation of the milk-secretion. Although the milk is generally of normal appearance when secretion continues in such cases, it frequently contains an increased amount of mineral salts, has a salty taste, and coagulates prematurely. While it is not known that milk of this kind is harmful to man, the change in its composition is sufficient to justify its condemnation as a food.

When suppurating wounds or ulcerative inflammations are present in any part of the body, there is danger of the milk being infected with the pyogenic organisms.

Diseases of Man transmissible through Milk.

Milk may act as a carrier of the infection of certain specific diseases of man. From time to time epidemics in which the infectious agent has been disseminated by milk have been reported, particularly outbreaks of typhoid fever, diphtheria, and scarlet fever. Fortunately such outbreaks are not common in New Zealand.

Farm Dairy Inspection.

The hygienic qualities of milk depend very largely upon the conditions at the source of supply. A knowledge of these conditions can be obtained only by an inspection of the dairy premises. As an adjunct to dairy inspection, bacterial testing and

other laboratory methods of examining milk are of great service. These will not, however, reveal whether a high bacterial count, for instance, is due to conditions existing at the farm, or during transportation of the milk to the consumer. On the other hand, inspection of a dairy-farm will disclose the physical condition of the cows, the sanitary condition of the premises, the character of the equipment, the methods in use, and the proficiency of the dairyman and his employees. Laboratory examination of milk, then, is of distinct value, but to produce results must be combined with dairy inspection.

Inspection of dairy premises should include a survey of the following :—

(1) *The Stock-yard :* (*a*) Floor ; (*b*) Drainage ; (*c*) Available water.

(2) *The Cow-shed :* (*a*) Site ; (*b*) Floor ; (*c*) Drainage ; (*d*) Lighting ; (*e*) Ventilation ; (*f*) Available water-supply ; (*g*) Cleanliness in shed.

(3) *The Cows :* (*a*) Cleanliness ; (*b*) Stage of lactation ; (*c*) Clinical examination of cows for symptoms of disease.

(4) *Hygiene of Milking :* (*a*) Cleansing of the udder ; (*b*) Leg-ropes ; (*c*) Cleansing of milkers' hands ; (*d*) The cleansing of the milking machine ; (*e*) Cleansing of cans and other milk utensils.

(5) *The Milk-house :* (*a*) Location ; (*b*) Construction ; (*c*) Drainage ; (*d*) Ventilation ; (*e*) Water-supply ; (*f*) Strainer ; (*g*) Cooler ; (*h*) Storage.

(6) *Bottling of Milk on the Farm :* The sterilization of bottles and hygienic methods of bottling milk.

Under the above headings much extended descriptive detail can be entered into. Only short reference will be made, however, to some of the more important points.

The site of the shed is important in relation to the prevailing winds and sunshine, and as regards drainage. The proximity of other buildings—horse-stables, fowl-houses, &c.—should be noted. Such are breeding-places for flies, and are therefore objectionable when too close to a dairy. The condition of the yard has a considerable effect upon the cleanliness of the cows : concrete floors are essential in yards. It goes without saying that the floor of the shed must be of concrete, likewise drains and sumps. When cows are not housed, the cubic air-space of the shed is not of vital importance. Ventilation must, however, be sufficient to at all times ensure elimination of "cow-odour." In sheds in which a feed-trough runs in front of the cows, such trough should be of cement, as this alone allows of proper cleansing. Feed placed before a tuberculous cow may be contaminated by infected saliva and the disease in this way transmitted to other cows. A concrete trough minimizes this possibility. Leg-ropes are preferably detachable, so as to be capable of being washed and hung up to dry. Dirty leg-ropes are most objectionable, as they are handled by the milker before milking begins. In walk-through sheds the handles of the doors require particular attention.

The examination of the cow is one of the most important parts of dairy inspection. The veterinarian, or the stock inspector who has received a suitable training, is alone competent to carry out his duty. Careful clinical examination of the cows includes palpation of the udder and palpation of the superficial lymphatic glands.

The progress of milking requires special observation. Herein lies the supreme test of the mentality of the dairyman for his job. Dirty milking procedure can only result in high bacterial count. Clause 13 of the regulations reads, "No person shall take milk from any cow whose milk is intended to be sold or used for human food, nor permit any such milk to be taken, until the udder and teats of such cow have been thoroughly cleansed." And in respect to the milker himself, clause 14 states, "Before commencing to milk any cow the hands of the person milking must be thoroughly washed and kept cleansed until the milking and handling of milk is finished for the time being." The provision of hot water, soap, nail-brush, and clean towel indicates the clean milker. Clean clothing must not be overlooked, and white overalls should be worn more frequently than they are. The milking-stool must be kept clean—a metal one with a hole for the hand in the seat is a good pattern. The practice of "wet" milking should not be tolerated. Dry milking is amongst the most important factors in clean milk production. Where machine-milking is employed very special attention must be directed to the cleaning of the machine and rubber parts. The method advocated is that known as "the boiling-water and caustic soda method," and has formed the subject of a departmental bulletin. Steam sterilization of cans and dairy utensils is an important item in dairy inspection.

The operations of cooling and straining the milk are carried out in the milk-house. The requirements regarding the construction of the milk-house have lately been under consideration, and it is proposed to embody certain structural requirements in an amended regulation. This refers to floor, walls, ceiling, ventilation, drainage, &c.

One of the most important details in the production of a pure milk-supply is proper cooling. A cooler, which is necessary for the rapid cooling of milk, is constructed so that the milk flows on a thin layer over a sheet of tinned metal while cold water flows on the other side of the metallic sheet and absorbs heat from the milk. Several types of milk-coolers are on the market. In some districts difficulty is experienced in the cooling of milk during the hot summer weather, when the water itself might be as high as 70° F. Under such conditions, some form of refrigerating plant is necessary. The bacterial count of milk is largely dependent on the manner and rapidity of cooling.

The practice of bottling milk at the farm has of recent years been on the increase. In many instances proper sterilizing apparatus for the sterilization of bottles has been installed, but in the majority of cases no such provision is made. The Department has had under consideration the desirability of making sterilization of bottles compulsory, and a regulation to this effect is about to be introduced.

Reference has already been made to bacterial testing, and other laboratory methods of testing milk, as an adjunct to dairy inspection. In England to-day certain standards are laid down in the Milk (Special Designations) Order. "Certified" milk must not contain more than 30,000 bacteria per c.c., and *B. coli* must be absent in every $\frac{1}{10}$ c.c. For "certified" milk the cows must be tuberculin-tested every six months until the herd is definitely free of reactors, when the test may be reduced to once a year. Grade A milk (tuberculin-tested) must not contain, at the time of delivery to the consumer, more than 200,000 bacteria per c.c., and *B. coli* must be absent in every $\frac{1}{100}$ c.c. In some districts in New Zealand, in co-operation with the Health Department, bacteriological counts of milks have been carried out, usually at hospital laboratories. The results are forwarded to the inspector of this Department, and afford him very valuable assistance in judging the manner in which the milk is being produced at the farm. In this connection it is desired to refer to the Gisborne milk-supply, where such examinations have been carried out for some years past, through the keen co-operation of the local medical officer of health with the departmental veterinarian in charge of dairy inspection at Gisborne. The results were indicated in a report some time back by the medical officer, which showed the existence in the Gisborne supply of a group of milkers supplying milk equal to the English "certified" standard. The practice has recently been introduced at Dunedin, and personally I should like to see its adoption in every centre.

The reductase test, in which methylene-blue solution and milk are mixed together, and the amount of reductase present, or the reduction power, indicated by the length of time required for the blue colour to disappear, is used as a general index of the bacterial content of milk and its keeping qualities. The reductase test is a valuable one when properly used for routine control purposes to detect the worst milk, but it has certain limitations which become more pronounced when attempts are made to use it at a high standard. It is known that the organisms which exert the greatest effect upon the test are the common milk streptococci (*S. lactis* types), while those germs such as coliform types, which are associated with dirty methods of milking and handling of milk, have a comparatively slight effect on the test. The standard of the Department of Health for the reductase test is three hours. Recently the question of extending this period to five hours has been under consideration. It is questionable, however, whether this would not be difficult to obtain in practice in some districts where difficulty is experienced in water-cooling in the hot, summer period. An extension, however, to 250 minutes might meet the position, and should be capable of being met by reasonable effort.

The question of pasteurization of milk is one upon which divided opinions exist. Whichever view is held, it must, however, be emphasized that efficient control of milk production on the farm is not affected. Pasteurization must never be regarded as an incentive to dirty methods of production. Probably the strongest argument in favour of pasteurization to-day lies in the elimination of danger of abortion infection from the milk-supply.

Dairy inspection is an exacting duty, calling for a degree of tact and the power to gain the confidence of the farmer on the part of

the inspector, apart from an intimate working knowledge of all the details connected with the production of milk for sale. Regarding the latter, it is held that the live-stock officer, on account of his specialized training, is the person pre-eminently suited to the performance of the duty, and the one who most readily secures the confidence of the dairy-farmer. The dairy inspector not only must see that certain regulations are complied with, but he has also an important instructional and advisory function to perform.

Finally, the viewpoint of the producer himself must be considered. Often is has been said that the most important factor in the successful production and handling of clean milk is the mentality of the worker. And this is perfectly true. How often does one see otherwise ideal conditions spoiled by the methods of a careless employee who is insanitary in his procedure? It is difficult, if not impossible, to inculcate ideas of clean milking and handling of milk in some people. The dairy-farmer cannot always be blamed personally for the neglect of his employees. It is his duty, however, to eliminate such carelessness, and it is towards this end that the practice of dairy inspection must always be directed. Let it be said that it is the endeavour of the majority of milk producers to produce milk of pure quality, and the primary object of regulatory control should be to assist in this achievement.

INVESTIGATION OF FEED-FLAVOUR IN BUTTER.

CORRELATION OF PASTURE TYPE AND STAGE OF GROWTH WITH INTENSITY OF FEED-FLAVOUR.

E. BRUCE LEVY, Agrostologist, Department of Agriculture.

As part of the policy of endeavouring always to obtain the highest possible quality in dairy-produce the matter of feed-flavour in butters has been the subject of a recent investigation. In this investigation, from the botanical point of view, some forty farms were visited and the pastures examined as to their botanical composition. Dominance of species was noted in respect to grasses, clovers, and weeds, and special attention was paid to stage and rate of growth and manurial practices followed.

Prior to the investigation many opinions were current as to the cause of feed-flavours in butters. It was contended—(1) That the type of pasture, particularly that induced by top-dressing, especially by superphosphate, was largely responsible; (2) that certain weeds and specific plants such as *Lotus major* were largely contributory to the trouble, (3) that it was largely a matter of dairy hygiene; (4) that it was not so much the class of food as the manner in which it was fed and the amount of scour it caused in the milking animal—*i.e.*, the problem was again one of dairy hygiene coupled with digestion troubles in the animal itself (the question of scour was specifically stressed in the matter of peat swamp land); (5) that the flavour might arise from the decomposition of butterfat by the action of ferments or enzymes which are present in all plants (these enzymes are held to break down the butterfat into fatty acids and glycerine, and it is the fatty acids that are held to cause the

taint and smell); (6) certain proprietary-manure interests have asserted definitely that superphosphate is to blame, and suggest that the remedy lies in the use of a non-acid manure made of rock-phosphate instead of superphosphate; (7) there is a very general agreement among Waikato suppliers that some modification of manuring methods, pasture, and herd management might succeed in lessening to some extent the strong feed-flavours.

It is obvious from the above opinions that a specific investigation into the whole question of food-flavours in butter was warranted.

The botanical investigation commenced early in September, and it soon became apparent that no specific weed in the pasture was responsible, the more weedy pastures in the early part of the season at least giving little or no feed-flavour, whereas the standard first-class pastures, dominantly rye-grass and white clover with little or no weed, gave the distinct characteristic feed-flavour in the cream.

A scheme for the testing and grading of cream was inaugurated by the manager of the Morrinsville Co-operative Dairy Co., Ltd., Mr. A. M. Stirling,* wherein the cream supplied night and morning from specially selected farms was subject to critical examination after its receipt at the factory and again the following day. Grading marks were allotted on a basis of 0 to 10, 0 meaning no feed-flavour and 10 the maximum of feed-flavour. Intermediate figures between 0 and 10 represented intermediate intensities in flavour. Bacterial count, or acidity, does not appear to be a factor affecting the incidence or intensity of feediness, but occasionally may confuse the issues. All creams classed as "off" or doubtful in purity were, however, excluded in assessing intensity of feediness of flavour.

Mr. Stirling was assisted in his grading by Mr. W. Dempster and Mr. E. Melton, of the Dairy Division of the Department of Agriculture. The whole of the investigation is under the direction of Professor W. Riddet, Director of the Dairy Research Institute.

At the outset of the investigation it was hoped that there might be a correlation between the dominant Waikato feed-flavour and specific plants, weeds, grasses, or clovers growing in the pasture, much in the way as it is reputed turnip-taint can be detected in the cream from cows fed on turnips.

In order to get this correlation between the characteristic feed-flavour and specific plants, my botanical assistant, Mr. E. A. Madden, who had had prior experience in cream-grading, spent some considerable time on the factory stage in acquiring the flavour under investigation. The feed-flavour, apart from a few odd exceptions, as, for example, that caused by hogscress and those due to bacterial contamination, proved to have a sameness that differed only in degree of intensity, and it was not possible to detect this flavour by masticating and tasting weeds, grasses, or clovers from areas known to give the characteristic flavour when fed on by the dairy cow.

Distillation of the more common plants would seem advisable, but this work must be done in such a way as to approximate as

* Mr. Stirling, by his enthusiasm and scrupulous care and attention to detail, has been largely responsible for the progress of these investigations to date. I especially wish to acknowledge this fact, and to thank also the directors of the Morrinsville Co-operative Dairy Co., Ltd., for their splendid co-operation.

near as possible the digestive processes of the animal itself. Some preliminary work by steam distillation has been done on several species by Mr. H. W. Boucher, B.Agr.Sc., on the staff of the Morrinsville Dairy Co., Ltd., but the results so far are not conclusive.

In the botanical surveys that were undertaken the following aspects were kept firmly in mind: (1) the botanical composition of the sward; (2) style of management and state and stage of growth when grazed by the herd; (3) the manurial practices adopted.

THE BOTANICAL COMPOSITION OF THE SWARD.

From a practical point of view there are four major farm types in the Waikato, having regard to botanical composition:—

Farm Type 1.—Heavily manured farms, heavily stocked over a period of years, resulting in a highly-producing, early spring sward that is dominantly perennial rye-grass and white clover. Such pastures are luscious in the early spring—August to September—and are prone to produce feed-flavours during this early growing period. Evidence to date goes to indicate that such pastures "harden" fairly rapidly and become less prone to produce feed-flavours. This certainly was true over the present season, which, however, has been exceptionally dry.

Farm Type 2.—Moderately well manured and in process of building up to a high per-acre stocking, but not approaching type 1 in high concentration of stocking because of the fact that less fodder per acre is produced on this type. The swards are of moderately high production and fairly early away in the spring, but not so early as type 1 above. The sward is dominantly white clover with rye-grass rising subdominant excepting near gateways or night paddocks, where a high concentration of stock is secured. Here the rye-grass is dominant over white clover. Cocksfoot, *Poa pratensis*, and Yorkshire fog, with some sweet vernal and suckling clover in the weaker parts, are also present. These swards are prone to produce feed-flavours over a fairly long period, and the evidence to date strongly indicates that swards of the type 2 farms are more taint-giving during the October November period than type 1, where the stubble growths of rye-grass running to seed-head appear to tend to reduce feed-flavours.

Farm Type 3.—Run-out swards or low-fertility soil types in the early stages of improvement by top-dressing, or where small quantities only of superphosphate or slow-acting phosphates are regularly applied. These swards are late away in the spring and carry an exceedingly low per-acre stocking. Such swards are dominantly suckling clover, sweet vernal, brown-top, and/or Danthonia, with some *Poa pratensis*, stunted Yorkshire fog, subterranean clover, and traces of white clover, rye-grass, and cocksfoot. During the present season such pastures produced feed-flavours late in the spring—end of October and November—and were, while the short flush lasted, the worst feed-flavour producing swards under investigation during the current season.

Farm Type 4.—Peat swamp country—these swards on the whole are weak in clover. They are essentially grassy swards, but many consist of poor types of grasses. The dominant species in the main are Yorkshire fog, brown-top, *Poa pratensis*, sweet vernal, with traces of rye-grass, cocksfoot, timothy, paspalum, and white clover. *Lotus major*

may be the dominant clover present. The better types may contain more cocksfoot, rye-grass, and paspalum, and the growth from Yorkshire fog is of a better quality; but the characteristic of peat swamps is largely their grassy rather than their clovery nature. Peat swamps throughout the investigation gave cream practically free of the characteristic feed-flavour. A short visit was paid to the Hauraki Plains, and several areas at Ngatea were examined. Those pastures on the whole are grassy, and top-dressing is the exception rather than the rule. The Ngatea pastures are renowned for producing a butter free of feed flavours. Stock-scour, however, is often extremely prevalent on the Hauraki Plains, and it would appear that there is little or nothing in the assertion that scour is associated with feedy flavour in the milk or cream.

The relative intensities of "feedy" flavours from three of the above four farm types are set out in Table 1 The figures in this table are based on the averages of two gradings of night cream, one grading taking place at 3.30 p m. on the day the cream arrives at the factory and the second grading at 8 a.m. in the following morning. In order to fix a basis for comparison and to deal with whole numbers rather than with decimals, 100 is arbitrarily taken to represent the strongest feediness met with in any individual grading Actually the examination was made on an 0–10 basis as before explained Farms of type 4 are not included, as these farms consistently show an almost entire absence of feediness. The number of farms in type 3 is small, and it is unfortunate that more of this type were not included in the investigation from the commencement It can be taken, however, that at the commencement there was little or no feediness in the cream of the farms from this type, and it was not until a strong feediness was detected that these farms were included in the analysis. Moreover, all the farms examined are not included in the table, for the reason that several were dropped out and others substituted in the course of the trial, and in some instances it was not possible owing to variations of sward from paddock to paddock and to differing soil types to classify particular farms in any of the farm types enumerated. Even as it is, there is no hard-and-fast dividing line between the farm types, and certain included in, say, type 1 have paddocks that should be included in type 2, and certain of type 2 have paddocks that should be in type 1 or 3. The type 3 farms also have odd paddocks, particularly about the homestead, that should be in type 1 or 2 It can be fairly definitely stated, however, when it comes to the period commencing 20th October, that the feediness figure indicates poorness in sward type—the higher the degree of feediness the poorer the sward. This refers purely to the farm types as set out in the table It does not include peat farms, and it is known to be true only for the year under review.

A rather interesting confirmation of the above conclusion took place during a short period of investigation at Cambridge on the 7th November. The cream of four suppliers was graded on the stage at the factory of the Cambridge Co-operative Dairy Co., Ltd. Three lots of cream were showing a high feed-flavour, and one was comparatively mild. The mild cream was from a good rye-grass white clover dominant sward, approaching type 1 farm, and the intensely "feedy" creams were from low-production farms of the 2–3 type. One of these, bordering on a type 3 farm, had not been top-dressed for years. It was dominantly white clover, suckling clover, sweet vernal, with much brown-top and some weak rye-grass.

Table 1.—Showing Individual Farms classified according to Pasture Type together with Feed-flavour Intensities of Night Cream for each Type over Specific Ten-day Periods

(100 = very strong feediness; 0 = no feediness The letter at the head of each column is the supplier's identification letter.)

Period.	Farm Type 1.										Farm Type 2											Farm Type 3.			
	A.	B.	C.	D.	E.	F.	G	H	I	Average	J	K	L.	M.	N.	O	P.	Q.	R.	S	Average.	T	U.	V.	Average.
10–19 September ..	..	36	39	54	40	41	25	58	38	41.4	..	57	44	32	54	61	..	39	..	..	47.8	..	..	..	..
20–29 September ..	4	5	5	7	7	21	7	25	16	10.8	..	6	20	3	13	19	..	28	..	..	14.8	..	..	..	..
30 September–9 October ..	5	8	..	15	3	2	15	30	21	12.4	..	22	22	22	30	25	..	46	..	..	27.8	..	..	..	..
10–19 October	6	20	..	7	10	11	30	31	36	18.9	..	40	38	40	45	43	..	30	..	..	39.3	..	..	..	..
20–29 October	23	20	20	22	21	18	22	33	37	24.0	33	36	33	26	39	47	26	37	43	28	34.8	40	..	65	52.5
30 October–8 November ..	26	23	15	..	4	12	20	20	34	10.2	52	42	38	38	46	43	34	46	46	40	42.5	38	..	60	49.0
9–19 November	6	5	0	3	0	0	8	20	32	8.2	46	10	28	32	28	34	20	40	36	32	31.5	33	..	30	31.5
20–29 November ..	6	12	0	2	8	0	9	20	17	8.2	33	11	1	18	21	31	10	16	23	9	17.3	35	33	27	31.6
30 November–9 December	8	27	..	..	15	0	16	27	8	14.4	36	..	0	23	6	18	14	32	13	18	17.8	24	33	14	35.5
10–19 December ..	10	5	0	5	0	1	1	3	10	3.0	12	4	0	3	0	1	1	5	0	3	3.5	4	0	1	1.6

Table 2.—Showing Individual Farms classified according to Pasture Type, together with Feed-flavour Intensities of Morning Cream for each Type over Specific Ten-day Periods

(100 = very strong feediness; 0 = no feediness The letter at the head of each column is the supplier's identification letter.)

Period.	Farm Type 1										Farm Type 2											Farm Type 3.			
	A.	B.	C	D	E	F.	G.	H	I	Average	J	K	L	M	N.	O.	P.	Q	R.	S	Average.	T.	U	V.	Average.
10–19 September ..	..	10	15	26	0	0	8	22	14	11.9	..	8	5	8	7	15	..	3	..	..	7.7	..	..	..	..
20–29 September ..	0	2	0	0	0	1	0	5	1	1.0	..	2	2	1	0	2	..	1	..	..	1.3	..	..	..	..
30 September–9 October ..	0	4	..	4	0	0	1	4	0	1.6	.	0	0	3	3	3	..	4	.	..	2.2	..	..	..	..
10–19 October	5	11	..	0	0	6	7	4	2	4.4	..	7	23	4	20	18	..	2	..	..	12.3	..	..	..	..
20–29 October	7	15	12	14	9	12	10	9	15	11.4	15	14	26	15	22	23	2	14	16	12	15.9	13	..	20	16.5
30 October–8 November ..	7	5	3	..	2	0	2	2	17	4.7	23	22	23	10	24	23	3	15	16	20	17.9	22	..	9	15.5
9–19 November	1	3	1	0	0	0	0	2	1	0.88	13	5	16	2	8	10	0	6	2	12	7.4	5	..	3	4.0
20–29 November ..	3	3	0	2	8	0	2	2	1	2.3	5	2	1	1	2	7	1	2	3	1	2.5	1	13	1	5.0
30 November–9 December	0	5	..	..	1	0	7	11	2	3.7	11	..	3	4	6	10	0	3	15	4	6.2	3	17	6	8.6
10–19 December ..	0	0	0	0	2	0	0	0	0	0.22	0	4	0	0	0	1	0	0	0	0	0.5	0	1	0	0.3

MANAGEMENT OF PASTURE, STATE AND STAGE OF GROWTH WHEN EATEN.

The contention among the farmers of the Waikato that pasture and herd management might succeed in lessening to some extent the strong feed-flavours seems to be substantially correct.

That there is something in herd management is clearly indicated by an examination of morning cream compared with the night cream from the same herd and shed, and often from the same pastures.

These comparisons between night and morning cream may be readily seen by a comparison of Table 2 and Table 1. Both these tables are set out on exactly the same basis, and it is consistently shown that the night cream is often strongly feedy, and the morning cream is comparatively mild. The average figures show a ratio of approximately 1–3½ throughout the main feeding periods, the night cream being actually 3·6 times as feedy as the morning cream throughout the same feeding periods of the season under review. There was no material increase in feed-flavour intensity with ageing of the cream. The fact that morning cream is less feedy than night cream does not support the opinion that enzymes or ferments are responsible for feed-flavour if it is correct that at night the plant tissues contain large amounts of these ferments and during the day the ferments are practically absent.

Some observations on the feeding habit of the dairy cow made by the writer may serve to throw some light on the reason for this difference between night and morning milk, and it is apparently largely influenced by the grazing habit of the cow at night as compared with day in relation to the amount consumed and the nearness or otherwise to milking-time that food is eaten. It is well known that if taint-producing feeds like turnips, cabbage, green lucerne, &c., are fed shortly prior to milking, bad feed-flavours develop; whereas if these are fed immediately after milking little or no taint is observed. The findings of the American work in this respect, particularly those of Dean,* Gamble and Kelly,† and Babcock,‡ go to show that if taint-producing feeds are fed at from four to five hours prior to milking little or no taint is produced. If we regard young, luscious, quickly-growing pasture as being a taint-producing food, then the time of eating of this prior to milking will have a very decided influence in the feediness or otherwise of the milk or cream produced. It was ascertained that little or no grazing is done by a well-fed dairy herd between the hours of 1 a.m. and milking-time. The following gives a very good idea of the night-time grazing of the herd:—

Time (p.m.) ..	7.0	7.30	8.0	8.30	9.0	9.30	10.0	10.30	11.0	11.30	12.0
Number grazing ..	73	67	20	0	0	0	0	33	42	32	15
Number standing about	3	9	8	19	10	3	18	29	24	28	44
Number lying down ..	0	0	48	57	66	73	58	4	10	7	17

Time (a.m.)	12.30	1.0	1.30	2.0	2.30	3.0	3.30	4.0	4.15
Number grazing ..	11	6	4	4	1	3	3	0	All
Number standing about ..	37	20	13	2	3	15	7	4	at
Number lying down ..	28	50	59	70	72	58	66	72	shed.

The nights on which the above observations were made were dark, and counts were made every half-hour by means of an electric

* Dean, H. H.: Experimental Farm Reports, *Ont. Ag. Coll.*, 1897; p. 59.
† GAMBLE, J. H., and KELLY, E.: *U.S. Dept. Ag. Bulletin*, 1097.
‡ BABCOCK, C. J.: *U.S. Dept. Ag. Bulletin*, 1190, 1208, 1297, 1326, and 1342.

spot-light run off the battery of the car, which was drawn up in the centre of the paddock. The herd under observation was of seventy-six cows, and only those cows standing up or grazing were actually counted.

A further observation was made on a bright moonlight night, when the number of cows grazing between 1 a.m. and milking-time was somewhat larger than on a dark night.

Observations made on a moonlight night with moon just past its full, bright and clear, in a herd of seventy-six cows were: —

Time (a m.)	12.30	1.0	1.30	2.0	2.30	3 0	3 30	3.45
Number grazing ..	6	15	7	4	9	6	8	All cows
Number standing about ..	18	5	2	2	3	5	6	assembled
Number lying about ..	52	56	67	70	64	65	62	at shed.

These observations go to show there is comparatively little grazing done between midnight and milking time in the morning, and this may have an important significance when coupled with the mild feed-flavour of the morning's cream as compared with night cream.

It brings up the question whether it is possible to manage the dairy herd in such a way that the luscious early spring growth is rationed so that the herd is off it and on non-luscious feed four to five hours prior to milking in the evening. The fact that the dairy herd automatically rations itself at night also points rather to the possibility of using the early luscious feed as night grazing rather than as day grazing as at present. A fairly standard practice at present is to put the cows in the day on to the young fresh luscious feed and then at night to put them on to harder feed, with or without hay or ensilage. Later on in the season the herd may at night have the run of day paddocks after these have been used as day paddocks for one or more days.

Another practice is to use special night paddocks regularly night after night. In all these practices the tendency is to graze fresh luscious feed by day and non-luscious or essentially grassy feeds by night. In view of the fact that the herd automatically rations itself by night it would appear sound as regards feed-flavour control to reverse this practice, giving the herd access to the more luscious feed after milking at night and the less luscious during the day, and particularly from mid-day until milking-time in the evening.

During the course of the investigation some attempts were made to ration the herd on several farms from mid-day onward, but the season was so erratic in respect to feedy flavour as to make these trials of little value. In addition, attempts to ration were made late in the season when hay and ensilage supplies were exhausted and when there were no special paddocks prepared for the purpose. Rationing under the above conditions was not wholly satisfactory, but none the less some slight improvement in the night cream was effected. It would appear that rationing in the case of the type 1 farms is essentially sound and practicable, because the trouble in the case of these farms comes early in the season when supplies of

hay and silage are still on hand. In the case of type 2 farms the trouble is more extended, and in the case of type 3 farms it comes so late that no hay or ensilage remains.

There seems to be little doubt that clovery pastures are essentially worse in causing feed-flavours than grassy pastures. This may be seen in comparing type 1 farms with types 2 and 3. The former are essentially grassy, or they have more paddocks that are essentially grassy, than is the case of farm types 2 and 3, the reason for which is explained later.

It would appear, if rationing is an essential to reduce feed-flavour in night creams, that an earnest endeavour should be made to get certain pastures on the farm more grassy, or to make more use during the day of the more grassy "night" paddocks than is made at present If each farm had two or three essentially grassy paddocks that are let get away somewhat long, and if these are used from, say, 11 a.m. to milking-time in the evening, then there is a fair possibility of the feed-flavour problem in the night milk being considerably reduced.

Newly laid down paddocks are essentially grassy, and if these are sown with certified rye-grass, cocksfoot, and paspalum, with a small amount of clover, they may be kept grassy for years by periodic dressings of sulphate of ammonia or ammoniated super. It is essential in following out such a practice to have the land well limed before using sulphate of ammonia either alone or in the form of ammoniated super. Nitrogenous manures are essentially grass-promoting, whilst phosphate, potash, and lime encourage clover rather than grass.

Type 1 farms are essentially grassy in virtue of the high per-acre stock-carrying capacity, as a result of which large quantities of quickly available nitrogen in the form of urine and dung are being applied regularly, and it is considered that when a farmer obtains a carrying capacity in the vicinity of one dairy cow per acre or a little better the farm definitely becomes grassy, and this offers the best final solution to the feed-flavour problem in the Waikato. It must be borne in mind that large areas of New Zealand are literally made by phosphate and stock, and in the making of these pastures the swards are essentially clovery—it may, in the early stages, be suckling clover or subterranean clover, or red clover in newly-sown pastures, and, later on, white clover associated with more or less grass according to the stock-nitrogen excreted by the grazing animal. In contradistinction to this phosphate-made country, naturally fertile country is essentially grassy rather than clovery, and in this the feed-flavour is not so acute. The Waikato soils are essentially light and pumiceous. They increase in warmth in the spring exceedingly rapidly, and when provided with adequate moisture give a remarkably early and luscious growth, and it would appear that there is something in the newly-formed rapidly multiplying tissues of the plant that is decidedly prone to cause taint in milk, and in this stage grass as well as clover may be contributory. The grassy swards, however, tend to mature and harden earlier than the clovers, and this hardening has a marked reducing effect on the taint-producing propensities of the herbage. Thus the type 1 farms are less prone to taint than the more clovery type 2 and 3 farms, particularly when the feed has hardened up somewhat.

There is another practice that may tend to reduce feed-flavour. It has been noted that certain farms approaching type 1 in pasture composition are worse than others. On these farms there is a tendency to keep the pastures shorter, either out of necessity or on the assumption that short, ever-growing fresh feed has a higher milk-producing value. The practice of keeping the sward short tends to encourage clover rather than grass and to produce greater quantities of young, vigorously growing leaf rich in protein, and these two factors appear to intensify feed-flavours. In three of the No. 1 type of farms particularly—*i.e.*, A, B, and E—there was shown a tendency to allow the swards to "get away" somewhat more markedly than the average, and this practice, whilst counter to the modern concept of pasture-utilization in the young luscious stage, still does appear to be a move in the right direction as far as quality products are concerned, particularly in an area where feed-flavours are strong. Allowing the pasture to develop more height—up to the 6 in. to 8 in. stage—operates in three ways: (1) Grasses are encouraged; (2) clovers are suppressed; (3) the herbage is older and more hardened.

The hardening of the pasture and consequent ageing of the leafage appears almost entirely to correct feed-flavours. This was noted particularly during the investigation as soon as a week or so of dry weather intervened between rains. In Table 1, for example, the period 10th–19th September followed rain, and the period 20th–29th September was dry. Actually rain fell from the 24th to the 29th, but this did not affect this period appreciably. Following the rains of the 24th–27th there occurred cold south winds that undoubtedly checked growth considerably. Feed-flavours continued to be comparatively mild until warm rains fell in the period 10th–19th October, when there was a decided increase, which, however, was again checked by cold weather a few days later. In the period ended 8th November mild seasonable weather with occasional showers was experienced, and this tended to increase feed-flavours in types 2 and 3 farms, as a result no doubt of fresh clover growth. In farms of type 1 during this period the rye-grass was starting to produce flower-heads, and even though fresh clover growth was made in those pastures the hardening of the rye-grass checked the rise of feediness on these type 1 pastures. In the period 9th–19th November the weather was hot and dry, and again intensity of feediness commenced to fall. The weather continued hot and dry with the exception of a light rain at the end of the foregoing periods, and this is reflected in a general drop in feediness, which then remained mild up to Christmas, when practically no feediness was manifest. Throughout these trials it is obvious that feediness is governed by weather conditions, and unless the weather is such as to promote rapid growth, particularly in clovers, no feediness is apparent. It is safe to state, therefore, that young, fresh, quick-growing growth, particularly in clovers, is largely responsible for feediness, and that once the plant ages, or is fed in conjunction with more hardened feeds, feediness declines. In order to test experimentally the effect of two classes of pasture, the following trial in collaboration with the Dairy Research Institute was inaugurated at Palmerston North.

Four cows were selected and grazed together for three days on a control paddock, the milk and cream being graded for flavour night and morning as at Morrinsville.

Two cows were then placed on pure rye-grass for four days, and two were placed on rye-grass and white clover, the clover being dominant. After the four-day period the cows were again placed together in the control paddock and were then again grazed on the pure rye-grass and rye-grass white clover; the cows that were on the rye-grass white clover during the first period being now put on to the pure rye-grass and those that were on the pure rye-grass were put on to the rye-grass white clover. The results of this trial are indicated in Table 3, and the figures show that the rye-grass white clover pasture tended to cause feediness whilst the pure rye-grass and the control paddocks, which were essentially non-luscious grassy swards, caused little or no feediness. The second period on the special feeds showed a much reduced feediness as compared with the first period, and this may be due to the fact that the rye-grass-clover sward had hardened somewhat, or it may have been due to the individuality of the cows.

Table 3.—Grazing Trial at Palmerston North showing degree of Characteristic Feediness when Cows are grazed on different Classes of Pastures.

(Points: 100 = very strong feediness; 0 = no feediness.)

—	Morning Cream.	Night Cream.	—	Morning Cream.	Night Cream.
Control Feed, Cows 1 and 2.			*Control Feed, Cows 3 and 4.*		
5/10/34 ..	0	0	5/10/34 ..	0	0
6/10/34 ..	0	0	6/10/34 ..	0	0
7/10/34 ..	0	0	7/10/34 ..	0	0
8/10/34 ..	0	..	8/10/34 ..	0	..
Rye-grass Pure, Cows 1 and 2.			*Rye-grass and White Clover, Cows 3 and 4.*		
8/10/34 ..	..	0	8/10/34 ..	..	50
9/10/34 ..	0	0	9/10/34 ..	10	40
10/10/34 ..	0	0	10/10/34 ..	10	40
11/10/34 ..	0	0	11/10/34 ..	5	35
12/10/34 ..	0	..	12/10/34 ..	30	..
Control Feed, Cows 1 and 2.			*Control Feed, Cows 3 and 4.*		
12/10/34 ..	..	0	12/10/34 ..	..	0
13/10/34 ..	0	0	13/10/34 ..	0	10
14/10/34 ..	0	0	14/10/34 ..	0	0
15/10/34 ..	0	..	15/10/34 ..	0	..
Rye-grass Pure, Cows 3 and 4.			*Rye-grass and White Clover, Cows 1 and 2.*		
15/10/34 ..	..	0	15/10/34 ..	..	0
16/10/34 ..	0	0	16/10/34 ..	0	5
17/10/34 ..	0	0	17/10/34 ..	0	20
18/10/34 ..	0	0	18/10/34 ..	0	0
19/10/34 ..	0	..	19/10/34 ..	0	..
Control Feed, Cows 3 and 4.			*Control Feed, Cows 1 and 2.*		
19/10/34 ..	..	0	19/10/34 ..	..	0
20/10/34 ..	0	0	20/10/34 ..	0	0

The Waikato experiments suggest that hardening of the herbage was largely responsible for the diminution of feediness in the second period of the trial on the special feeds.

The trials at Palmerston North were not very refined, and the results must be taken as only an indication rather than as conclusive. The whole question of nutritional effects of feeds used, with their influence on quality of animal-products, needs careful investigation on a well-planned and refined basis.

THE MANURIAL PRACTICES ADOPTED IN RELATION TO FEEDINESS.

There is a widespread feeling that top-dressing with phosphate is directly or indirectly the main cause of feediness. It has been pointed out that feed-flavour in cream is apparently due largely to the clover when this is in a rapid stage of growth. It may be suckling clover, subterranean clover, red clover, or white clover. In the case of certain farms where suckling clover is dominant little or no top-dressing has been applied during the last five years, therefore top-dressing cannot be blamed for feed-flavours in those instances, and yet the taint is identical with that secured on heavily top-dressed farms. Nevertheless it is obvious that top-dressing with phosphate, potash, and lime intensifies feediness in proportion to the growth of clover that such manures encourage, and it appears that the value of a phosphatic manure is relative to the clover growth it promotes. If certain phosphatic manures do not increase feedy flavour in the early stages of pasture improvement in such soils as the Waikato, then they can be discarded. There has been an increase in the use of superphosphate, which is the main fertilizer used in the Waikato, and there has undoubtedly been a marked increase of feediness, a sure indication that superphosphate is doing its job of increasing production. Some farmers to-day, seeing this increase of feediness, are hesitant about applying more superphosphate and tend to look for other fertilizers or to reduce the use of superphosphate. This is bound merely to increase feediness and to result in loss of production, and it will prolong the time of transition from the clover-dominant to the grass-dominant phase. If Table 1 is examined, the results of a skimpy, hesitant policy in regard to the use of superphosphate, as against that of the heavy top-dressing, are seen. Farms of type 3 receive scarcely any top-dressing at all, and if the percentage of feedy cream in relation to the yearly output were worked out it would be in relation to the whole output far in excess of farm types 1 and 2. The owners of farms of type 2 may be regarded either as hesitant relative to superphosphate and those who have been changing over to more slowly acting phosphates or ones who are in the throes of "top-dressing through" the clovery phase. The owners of farms of type 1 are definitely heavy users of top-dressing, and in addition to superphosphate may have used lime, potash, or basic slag, but superphosphate has been the basis of their manurial top-dressing. Their production has risen enormously, and they are amongst the highest per-acre producers in the Waikato. Their paddocks are becoming essentially grassy and the feed-flavour problems develop early in the spring, when it is considered a good farming practice to ration the young spring grass with hay or ensilage. These men are now in a position to make several of their paddocks dominantly rye-grass by the use of ammoniated super, and are in a position to allow one or more paddocks to get away somewhat more rank for specific rationing purposes along with the more clovery fields

that, if fed alone, would give trouble. However we view the top-dressing practice in the Waikato or elsewhere, the fundamental fact remains that the more stock we can carry per acre and the better we can feed that stock the more grassy will the sward become as a result of the essential nitrogen returned to the sward by the grazing animal itself. Artificial nitrogen may help us out in getting to this ideal quickly in the Waikato, but it has been proven that it can be done with quick-acting superphosphate, with or without lime and potash.

Weeds in relation to Feediness.

As far as the major problem of feediness in the Waikato is concerned, over the area investigated at least, weeds can be eliminated as a source of the main trouble. The most common weeds of the Waikato are catsear (*Hypochaeris radicata*), and rib-grass (*Plantago lanceolata*). Scotch thistle (*Cnicus lanceolatus*), Californian thistle (*Cnicus arvensis*), Selfheal (*Prunella vulgaris*), Dandelion (*Taraxacum officinale*), cudweed (*Gnaphalium luteo-album*), field daisy (*Bellis perennis*), hawkbit (*Leontodon hispidus*), Hawkweed (*Crepis virens*) are common. Rush (*Juncus* spp.), buttercup (*Ranunculus sardous* and *R. repens*), dock (*Rumex* spp.), greater plantain (*Plantago major*), and pennyroyal (*Mentha pulegium*) are prevalent in the wetter soils, and the lesser spearwort (*Ranunculus flammula*) is common in wet water-logged areas. For the most part these weeds are common to all farms and are in greater numbers, and contribute more to the total feed consumed on farms where feed-flavours are mild.

Certain specific weeds such as hogcress (*Senebiera didyma*), popularly known as land cress in the Waikato, pennyroyal, watercress, &c., are said to impart characteristic feed-flavours in the cream, but these can be detected apart altogether from the characteristic feed-flavour under investigation.

In regard to hogcress, this is essentially a weed of newly sown pastures or of pastures where the turf has been broken by the ravages of grass-grub or by smother through the dumping of shed refuse. One is diffident to advise the breaking-up of pastures in those areas where hogcress is likely to be bad, but unless good strains of rye-grass and white clover were originally sown it is better to risk hogcress for the first year rather than waste time and fertilizer in attempting to repair swards that are too poorly constituted to respond. Ploughing and resowing with good strains and maintaining the newly sown sward by top-dressing are likely to lead to a grassy sward much more quickly than repairing a weak pasture by top-dressing.

Conclusion.

The suggestions outlined in this report offer no explanation of the actual factor or factors responsible for feediness. The explanation is probably wrapped up in the complexities of chemical changes associated with very rapid growth—rapid formations of carbohydrate materials; transformation of these to soluble sugars by ferments; the rapid absorption of nitrogenous and mineral compounds and the chemical reactions in the formation of proteins of which young growth is rich. There may be a specific material responsible for feediness, and if this

is so, and it could be isolated, some direct counter attack might be possible, but in the meanwhile it would appear that control or diminution of feediness largely rests in adoption of the following practices :—

(1) Every endeavour should be made to make pastures grass-dominant rather than clover-dominant. Heavier manuring with quickly acting phosphates such as superphosphate with occasional dressings of ammoniated super and lime is recommended, and, where pastures are "run-out," ploughing and resowing to certified strains of grasses and clovers is advised rather than top-dressing the deteriorated pastures, as the latter practice must inevitably mean up to three years of clover-dominance, whereas ploughing and resowing gives grass-dominance the first year.

(2) The more clovery feeds should be grazed after milking rather than from three to four hours prior to milking, and some consideration should be given to the class of feed given during the day as against that at night, tainting at night being less pronounced even when on the same class of feed—sometimes the same paddocks—as a result of the cow grazing mainly prior to midnight.

(3) To permit of the foliage hardening to some extent, pasture-herbage, during periods of rapid growth, should be allowed to grow to a somewhat more mature stage before grazing. The mowing of clovery swards and the feeding of these in the wilted stage may also be effective, if practicable.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1934.

W M SINGLETON, Director of the Dairy Division, Wellington

FIRST-CLASS certificates-of-record were issued to 637 cows in 1934, as compared with 507 cows in 1933, an increase of over 25 per cent. The figures for 1932, 1931, and 1930, were 486, 737, and 643 cows respectively. In view of the considerably reduced incomes of breeders during the past five years on account not only of the low level of butterfat returns, but also of the diminished prices offering for pedigree dairy stock, the general position is very satisfactory. It points to a realization on the part of breeders of the value and importance of testing, and a willingness to make financial sacrifices in order to maintain continuity of butterfat records. The wisdom of this attitude is obvious to any one who is conversant with the advantages of authenticated dairy-cow yields, but it is gratifying to those who control the C.O.R. Test to know that the system has the support of so many of our breeders of purebred dairy cattle.

Of the 637 cows which received first-class certificates last year, 534 were in the yearly-test division and the remaining 103 in the 305-day division. The comparative figures for 1933 were 461 and 46 respectively, so that the ten-months class experienced an increased support to the extent of over 100 per cent.

(1) C.O.R. YEARLY TEST DIVISION.

Although the number of cows qualifying for first-class certificates in the yearly division during the period under review was 534, the number of certificates represented was 536, the difference of two being accounted for by the fact that two cows each received two certificates during the year. The 536 certificates represented an average production of 527·45 lb. butterfat, an increase of 4·35 lb. over the 1933 average of 523·10 lb. fat for 461 certificates. It is pleasing to note an increase in average production running hand in hand with an increase in number of cows.

First-class Certificates issued.

Cows which have been granted first-class certificates since the inauguration of the C.O.R. system in 1912 now number 9,019. Subdivided into breeds this total represents 6,561 Jerseys, 1,720 Friesians, 443 Milking Shorthorns, 218 Ayrshires, 68 Red Polls, 2 Guernseys, and 7 Shorthorns. Table 1 provides a numerical summary of yearly certificates of the first-class issued during the past two years :—

Table 1.

Breed.	1934.			1933		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	415	41	456	337	35	372
Friesian	41	18	59	54	15	69
Milking Shorthorn..	9	3	12	11	1	12
Ayrshire	2	..	2	5	..	5
Shorthorn ..	..	..	..	1	..	1
Red Poll	6	1	7	..	2	2
Totals ..	473	63	536	408	53	461

Second-class Certificates issued.

Only two breeds were represented in this class, 35 second-class certificates being issued to Jerseys and 1 to a Milking Shorthorn, making a total of 36, in comparison with 37 for the previous year. The average production of the 35 Jerseys was 516·90 lb. butterfat, while the Milking Shorthorn cow was credited with 508·61 lb. fat.

Third-class Certificates.

During the past year 193 third-class certificates were issued to Jerseys, 17 to Friesians, and 2 to Milking Shorthorns, one cow in the Jersey breed receiving certificates on two separate performances. The average for the Jerseys was 497·20 lb. fat from 8,818·6 lb. milk in 353 days, for the Friesians 565·16 lb. fat from 15,834·3 lb. milk in 330 days, and for the Milking Shorthorns 600·17 lb. fat from 14,144·1 lb. milk in 365 days. While there were several good performances among these third-class certificates none were sufficiently outstanding to warrant particular mention.

Period between Calvings.

The average period between calving for commencement of test and calving subsequent to test for the 534 cows granted first-class

certificates during the year was the same as for the preceding twelve-month, namely, 403 days. The corresponding period for the second-class cows was 463 days, as compared with 467 days for the preceding year. Seeing that the maximum period allowed for calving for first-class C.O.R. is 455 days, it is obvious that those cows which fail to qualify for this class are doing so by a very narrow margin, and, moreover, that breeders are endeavouring to have their cows calve within the period specified by the rules for first-class C.O R.

Jerseys.

Class Leaders.

Although each time there is occasion to make a change in the list of class leaders for any breed it is felt that probably several years will elapse before any of the existing records are superseded, it is remarkable how each year seems to produce a new champion in one or other of the classes. This year's alteration occurs in the Jersey breed and in the Junior Two-year-old class. The new leader is Beechlands Summer Lass, while Greencroft Golden Grace is the cow which is displaced. Beechlands Summer Lass was bred and tested by Messrs. A. Moreland and Sons, Te Rapa, and, as will be seen from Table 2, gained her certificate for the phenomenal performance of 899·25 lb. fat. This yield is all the more remarkable when it is considered that she calved for commencement of test at under two years of age, and that she was milked only twice daily during her entire testing period. The record of Mr. J. Bones's Greencroft Golden Grace was 864·61 lb. fat from 14,678·4 lb. milk on a test commenced at two years eighteen days. This was on three times a day milkings. The Jersey class leaders are as follows:—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Beechlands Summer Lass	A. Moreland and Sons, Te Rapa	1 343	275·5	365	15,467·2	899·25
Senior Two-year-old. Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old. Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old. Woodlands Felicie	P. J. Petersen, Waitara	4 364	384·9	365	17,332·6	1,220·89
Mature. Holly Oak's Annie..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

FIG. 1. BEECHLANDS SUMMER LASS (A. MORELAND AND SONS, TE RAPA).

New class leader in junior two-year-old class: 15,467·2 lb. milk, 899·25 lb. butterfat. [N.Z. Farmer photo.

FIG. 2. MAORI JUDY (MRS. G. E. O'SULLIVAN, INGLEWOOD).

Highest C.O.R. Jersey, 1934, in senior two-year-old class: 13,114·7 lb. milk, 714·29 lb. butterfat.

Jersey Class Averages.

The average production represented by all Jersey certificates issued in the yearly division during the year was 518·02 lb. fat, an increase of 4·93 lb. over the 1933 average of 513·09. In view of the fact that the number of certificates issued for this breed rose from 372 in 1933 to 456 in 1934, the breeders concerned have reason to be proud of their achievement. Taking the classes individually, the junior two-year-olds and the three-year-olds both showed a substantial increase in average yield, while the remaining classes declined. The detailed position may be noted from Table 3, in which the class averages for 1934 and 1933 are given.

FIG. 3. RESHURE FLIRT (H. S. FLEMING, CLEVEDON)

Highest C.O.R. Jersey, 1934, in three-year-old class. 11,444·4 lb. milk, 751·56 lb. butterfat

[*N.Z. Farmer photo.*

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1934.		lb.	lb.
Junior two-year-old	188	360	8,246·7	473·65
Senior two-year-old	46	356	8,442·2	492·32
Three-year-old	60	359	9,439·1	540·59
Four-year-old	47	355	9,868·9	566·31
Mature	115	355	10,239·6	569·31
	1933.			
Junior two-year-old	150	358	7,868·3	449·63
Senior two-year-old	44	356	8,931·5	500·61
Three-year-old	56	358	9,415·3	524·62
Four-year-old	43	354	10,613·7	602·26
Mature	79	358	10,487·8	583·83

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 are given in Table 4:—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	2,947	348	7,192·0	404·46
Senior two-year-old ..	786	346	7,875·2	445·29
Three-year-old	1,093	345	8,600·0	481·16
Four-year-old	757	347	9,194·5	513·24
Mature	1,810	347	9,529·5	524·44
All	7,393	347	8,250·1	460·65
Average test, 5·58.				

Jersey C.O.R. Bulls.

The names of 2,391 different sires now appear on our Jersey lists, and of these, 472 have qualified for the C.O.R. class. A bull is classed as a C.O.R. bull when he has four or more daughters with first-class certificates, each daughter being from a different dam. Twenty-eight bulls have now qualified for the Jersey Cattle Breeders' Association's champion butterfat bull class, the qualifications for this class being as follows: Each bull must have five or more daughters which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years of age, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. It is not necessary for each daughter to be from ,a different dam. (The corresponding standards for cows in the 305-day test are 460 lb., 510 lb., and 620 lb. butterfat respectively.)

Friesians.

Class Leaders.

There were no changes in Friesian class leaders during the year. There were, however, a number of outstanding performances, one worthy of special mention being that of the Piri Land Co.'s remarkable producer Totara C.R. Buttercup. During the year this cow gained a certificate for 28,073 lb. milk containing 1,050·07 lb. fat, which makes two successive performances exceeding 1,000 lb. fat. Her individual records to date are as follows:—

Age.		Days.	Milk.	Fat.
Yrs.	dys.		lb.	lb.
2	205	365	21,208·6	790·66
3	247	365	25,885·3	989·10
4	267	365	27,108·1	1,079·14
5	308	365	28,073·0	1,050·07
Average ..		365	25,568·7	977·24

Totara C.R. Buttercup is again on test, though the parched conditions are exerting their toll, and she will not measure up to her average for the past four seasons. Nevertheless, if she continues in good health Totara C.R. Buttercup will make history from the point of view of long-distance performance. From the point of view of individual records she still holds the leading position in the senior three-year-old and the senior four-year-old classes. The Friesian class leaders are now as shown in Table 5 below.

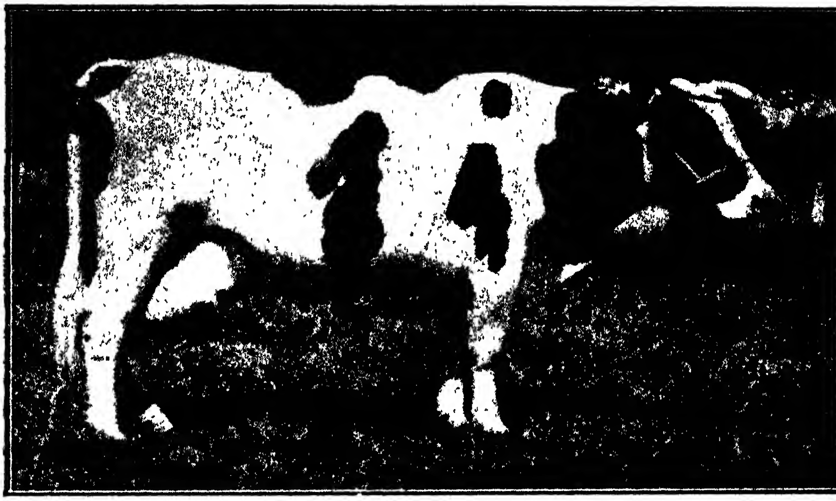

FIG. 4. TOTARA C.R. BUTTERCUP (PIRI LAND CO., AUCKLAND).
See text for details of outstanding performance.
[Dairy Exporter photo.

Table 5

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat required for Certificate	Yield for Season.		
					Days.	Milk.	Butter-fat.
		Yrs.	dys.	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2	16	242·1	365	20,501·1	740·50
Senior Two-year-old. Pareora Echo Blossom	T. Sheriff, Clandeboye	2	223	262·8	365	22,671·9	819·81
Junior Three-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	3	56	282·6	365	21,609·3	800·18
Senior Three-year-old. Totara C.R. Buttercup	Piri Land Co., Auckland	3	247	336·7	365	25,885·3	989·10
Junior Four-year-old. Totara Veeman Lulu	Piri Land Co., Auckland	4	12	349·7	365	22,364·2	946·78
Senior Four-year-old. Totara C.R. Buttercup	Piri Land Co., Auckland	4	267	375·2	365	27,108·1	1,079·14
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7	355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

There was a falling-off in the number of Friesians entered for test during the year, the number of certificates being 59, as compared with 69 during 1933. From the point of average production, however, the position is extremely favourable, inasmuch as the average for the breed rose from 589·01 lb. fat for 1933 to the very high figure of 622·87 lb. fat for the period under review. A point which calls for special notice is the average of 744·10 lb. fat for the seventeen cows in the mature class. Individual records in this class ranged from 606·82 lb. fat for a cow withdrawn after 212 days on test to 1,050·07 lb. fat for Totara C.R. Buttercup. There was certainly a strong class last year. The Friesian class averages for 1934 and 1933 are as shown in Table 6 below.

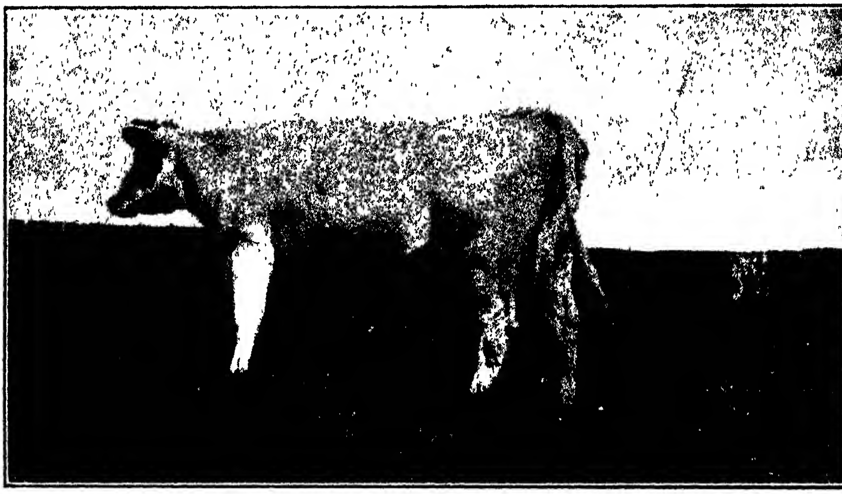

FIG. 5. MONEVILLE SYLVIA POSCH MERCENA (M. S. RENNIE, MANGERE).
Highest C.O R. Friesian, 1934, in senior two-year-old class: 20,589·5 lb milk, 764·09 lb. butterfat.

Table 6.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1934.		lb.	lb.
Junior two-year-old ..	14	363	13,867·5	493·01
Senior two-year-old ..	9	365	15,257·4	563·57
Junior three-year-old ..	7	365	17,577·3	632·50
Senior three-year-old ..	5	358	17,851·5	685·89
Junior four-year-old ..	4	330	15,868·0	561·55
Senior four-year-old ..	3	356	18,965·2	674·62
Mature	17	352	20,212·7	744·10
	1933.			
Junior two-year-old ..	25	361	13,721·3	490·50
Senior two-year-old ..	6	365	15,966·9	582·18
Junior three-year-old ..	2	365	18,415·5	679·73
Senior three-year-old ..	3	364	18,073·1	618·51
Junior four-year-old ..	7	356	18,133·7	674·97
Senior four-year-old ..	4	365	18,150·5	687·85
Mature	22	351	18,127·1	645·24

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system in 1912, are given in the following table :—

Table 7.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year old ..	638	346	11,899·2	422·92
Senior two-year-old ..	266	348	12,802·1	455·96
Junior three-year-old ..	191	343	13,550·4	477·26
Senior three-year-old ..	191	337	14,108·8	507·01
Junior four-year-old ..	133	345	15,280·1	541·71
Senior four-year-old ..	132	347	16,207·0	567·98
Mature	582	342	16,147·2	568·44
All .. .. Average test, 3·54.	2,133	344	13,993·6	495·51

Friesian C.O.R. Bulls.

Two new names were added to the Friesian C.O.R. bull list during the year, the total now being 117. Some 613 sires are represented in the 1,744 Friesian cows (including the 305-day division) certificated to the end of 1934.

Milking Shorthorns.

Class Leaders.

There are no changes to report so far as the Milking Shorthorn class leaders are concerned. The highest record of the year was that of the mature cow Ashley Bank Sea-Spray, owned by Mr. J. Peach, of Sefton. This cow is credited with 709 lb. fat from 16,280·4 lb. milk produced in 365 days on a record commenced at 9 years 11 months. The Milking Shorthorn class leaders are as follows :—

Table 8.

Name of Cow and Class	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days	Milk	Butter-fat.
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old. Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old. Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old. Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old. Matangi Rugh 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old. Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old. Ashley Bank Winsome	Peach Bros., Sefton	4 298	378·3	365	17,687·7	730·93
Mature. Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

The number of cows of this breed which received certificates in 1934 was 12, the same number as in 1933. Their average production was 516·41 lb. fat from 12,412·7 lb. milk in an average lactation of 352 days. Seven of the cows were in the mature class, two in the junior four-year-old, one each in the junior three-year-old, senior three-year-old, and senior four-year-old class.

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914, are given in the following table :—

Table 9.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	54	348	8,360·9	343·32
Senior two-year old ..	40	349	8,855·0	366·44
Junior three-year-old ..	26	335	9,731·4	392·55
Senior three-year-old ..	31	343	10,801·5	449·24
Junior four-year-old ..	26	350	11,097·5	454·38
Senior four-year-old ..	33	342	11,621·2	462·05
Mature	279	341	11,810·4	473·19
All .. .. Average test, 4·03	489	343	10,962·5	442·56

Milking Shorthorn C.O.R. Bulls.

No further Milking Shorthorn bulls qualified for the C.O.R. class during the year, the total remaining at fourteen. Some 146 sires were represented in the 443 cows of this breed certificated to the end of 1934.

Ayrshires.

Only two Ayrshires qualified for first-class C.O.R. in 1934. One of these, Dominion Jessabel, was a two-year-old bred at the Government Farm, Ruakura, and produced 363·28 lb. fat in 323 days. The other, a mature cow bred and tested by Messrs. W. Moore and Son, Masterton, gained a certificate for 640·44 lb. fat from 16,016·4 lb. milk in 365 days, having commenced her test at the age of 8 years 1 day. Neither of these performances affected the class leaders, the list remaining as follows :—

Table 10.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria ..	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	646·98
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912, are supplied by the following table :—

Table 11.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	69	345	8,995·1	373·40
Three-year-old	38	347	10,043·0	414·16
Four-year-old	27	346	11,378·0	459·52
Mature	110	348	11,942·9	485·96
All .. .. Average test, 4·09.	244	347	10,750·9	440·02

Ayrshire C.O.R. Bulls.

No new names were added during the year to the list of Ayrshire C.O.R. bulls. The total is eleven, while 124 sires are represented in the 219 Ayrshire cows which have received certificates to the end of the calendar year 1934.

Red Polls.

Six cows of the Red Poll breed received certificates during the period under review, three being in the two-year-old class, two in the three-year-old, one in the four-year-old, and one in the mature. There were no outstanding performances. The six cows represented seven certificates, as one cow received two certificates during the year. The average production of the seven certificates was 363·65 lb. fat from 7,645·6 lb. milk in 349 days The list of class leaders remains as follows :—

Table 12.

Name of Cow or Class.	Tested by	Age at Start of Test.	Fat required for Certificate	Yield for Season.		
				Days.	Milk.	Butter-fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Wayward 6th B No. 1	G. S Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Waihou Pip ..	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

Red Poll Class Averages.

The averages, class by class, for all certificates issued by Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as shown in Table 13 on the following page.

Table 13.

Class.	Number of Certificates.	Average Yield for Season. Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	42	345	7,560·6	336·21
Three-year-old	16	346	7,905·1	349·63
Four-year-old	8	349	9,806·8	430·72
Mature	25	340	10,569·1	445·66
All .. .. Average test, 4·36.	91	344	8,645·1	376·95

Red Poll C.O.R. Bulls.

There are no new names to be added to the Red Poll C.O.R. bull list, the number remaining at four. The sixty-nine cows of this breed (including one in the 305-day division) certificated to date represent twenty-seven different sires.

(2) C.O.R. 305-DAY TEST DIVISION.

Of the 103 first-class 305-day certificates issued during the year under review 94 went to Jerseys, 8 to Friesians, and 1 to an Ayrshire. In addition, 3 Jerseys and 2 Friesians were granted second-class certificates in the 305-day division.

Jerseys.

Class Leaders.

Two changes took place in the class leaders. In the junior two-year-old class Erinview Moss, with 576·44 lb. fat, takes the place of Erinview Empress, with 523·99 lb. fat, both cows being owned by Mr. J. Murray, of Woodville. The other change relates to the four-year-old class, Hatcliffe Lady Gay, with 664·49 lb. fat, displacing Montrose Leonie (560·29 lb. fat), owned by Mr. V. J. Williams, Pukekohe. The class leaders are now as follows:—

Table 14.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Erinview Moss ..	J. Murray, Woodville	2 25	253·0	305	10,294·0	576·44
Senior Two-year-old.						
Erinview Joan ..	J. Murray, Woodville	2 339	284·4	305	10,130·1	607·08
Three-year-old.						
Glendale Silver ..	A. Montgomerie, Kauwhata	3 319	318·9	305	11,352·7	631·42
Four-year-old.						
Hatcliffe Lady Gay ..	H. J. Kaye.. ..	4 60	329·5	305	10,619·9	664·49
Mature.						
Perfection's Hopeful	J. A. Mitchell, Longburn	5 339	360·0	305	11,090·7	664·51

Jersey Class Averages.

The production averages, according to age class, of the 94 first-class certificates issued to cows of the Jersey breed during the year under review are given in Table 15. The average for all the cows was 426·40 lb. fat and the average test 5·64 per cent.

Table 15

Class.	Number of Cows.	Average Yield for Season. Days in Milk.	Milk.	Butterfat.
	1934.		lb	lb
Junior two-year-old ..	41	291	6,555·1	372·28
Senior two-year-old ..	9	300	7,142·8	403·72
Three-year-old	13	300	7,968·2	458·80
Four-year-old	12	299	8,734·5	513·46
Mature	19	298	8,845·2	476·80

Friesians.

Class Leaders.

There are two new class leaders during the year so far as the Friesian 305-day division is concerned, one in the junior two year-old class and the other in the junior three-year-old class. The junior four-year-old class still remains blank, no cow having yet been entered in this class. The class leaders are now as follows:—

Table 16.

Name of Cows and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb		lb.	lb.
Junior Two-year-old						
Sealands Magpie Pietertje 2nd	H. G. A. Cameron, Weraroa	2 22	252·7	305	11,727·4	454·16
Senior Two-year-old						
Rosevale Beauty Posch Griselda	E. H. Watson, Windsor	2 216	272·1	305	12,273·5	468·50
Junior Three-year-old.						
Totara De Kol Nina	Piri Land Co., Auckland	3 117	298·7	305	16,005·9	501·37
Senior Three-year-old.						
Sealands Alcartra Fobes	H. G. A. Cameron, Weraroa	3 304	317·4	305	10,407·8	389·04
Junior Four-year-old	..	..	..	..	..	..
Senior Four-year-old.						
Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4 357	359·2	305	15,311·9	557·71
Mature.						
Ellerlea Egie Segis Minto	C. H. Steadman, Pokapu	6 345	360·0	305	16,303·1	650·85

Friesian Class Averages.

The average production of the eight Friesians gaining certificates during the year was 437·04 lb. fat from 12,481·4 lb. milk in 304 days.

A pleasant feature of the conduct of the C.O.R. test is the unfailing courtesy and co-operation of the breeders' associations which are connected with this work. It is desired once more to record our thanks.

THE ERADICATION OF SOME PARASITES AFFECTING STOCK.*

J. E. McIlwaine, Veterinary Officer, Animal Husbandry Section, Wellington.

External Parasites of Cattle and Horses.

Although cattle may be free from skin parasites, at this season of the year inquiries are from time to time being made in regard to the treatment of cattle infested with lice. Cattle which are liable to be affected with lice are mainly young stock in a poor unthrifty condition and dairy cows which are low in condition. The majority of cases is therefore seen in stock in the winter and early spring months.

Occasionally very fat cattle are found to be affected. When affected with parasites the stock show evidence of excessive licking of the coat. The hair may be rubbed off in the region of the neck and tail, the animals are restless and frequently may be seen rubbing against posts, gates, and even the wire fences may suffer in consequence.

When stock are in such condition they do not readily put on flesh, and it is advisable to eradicate the parasites and at the same time to increase the food-supply so as to enable the animals to recover completely.

Although dipping the stock in cattle-dip is carried out for the destruction of ticks, it is seldom that large numbers of cattle are required to be treated for lice. Inquiries which have been received from farmers indicate that the majority requires some preparation for the hand dressing of a few stock. For this purpose the soap-kerosene emulsion has been found very effective. The following is the method of preparation of the emulsion: ½ lb. of soap is thoroughly dissolved in 1 gallon of boiling water. The next step is to add 1 pint of kerosene, at the same time stirring the soapy emulsion thoroughly. The whole is then diluted with water to make a total quantity of 4 gallons. When cold, the preparation is ready to be applied.

This preparation may be applied to the affected parts by using an ordinary grooming-brush. If the parasites are numerous and spread over the body, it is advisable to dress one quarter of the body only at any one dressing. It is advisable to repeat the application in from eight to ten days in order to destroy any parasites which have hatched out since the previous application.

* Portion of an address broadcast from Station 2YA.

This preparation can be used with equally satisfactory results in the case of horses. Quite recently a farmer dressed his horse with an arsenical preparation for the eradication of lice, the horse dying from the absorption of arsenic.

Mercurial ointments, although effective, are dangerous on account of the possibility of the mercurial preparations being licked off by the animal.

External Parasites of Pigs.

In the case of external parasites on pigs any oily preparation appears to give very satisfactory results. In this respect it may be mentioned that on account of the very warm, dry summer some pig-farmers may have considered the question of putting down a concrete wallow for the animals. Where shade from trees is not available such a wallow might be employed more extensively. The water in the concrete wallow should be coated with a thin layer of ordinary machine oil. When the pigs leave the wallow a coating of oil is left on the backs of the animals, and this effectively kills the parasites on the skin. Other means of applying oil to the skin of pigs apart from hand treatment of the animals consists of wrapping sacks saturated in oil round the rubbing posts in the pig paddock or pen. There is no doubt whatever that stock of all classes do better when free from parasites, and this specially applies in the case of pigs. Moreover, treatment on these lines, which need not be expensive or elaborate, will assist in the prevention of sarcoptic mange in pigs, and may also indirectly assist in the prevention of those black necrotic ulcers which sometimes form on the skin of pigs. All measures taken to relieve skin irritation and restlessness will result in increased gain in bodyweight per unit of food consumed.

Internal Parasites of Stock.

Many sheep-farmers and dairy-farmers will now be considering the treatment of their young stock for worms. Lungworm infestation of both calves and lambs is met with in young stock at this season of the year. On account of the dry season it may not be so prevalent as in other years, but there is no doubt about its prevalence on many farms. The disease is more prevalent on low-lying farms where the young stock are grazing in close contact, and where the carrying-capacity is higher than on poorer country. The characteristic symptom of the complaint is the dry husky nature of the cough. This cough is more evident after the animals have been exercised as in yarding. The affected animals cough persistently, the tongue often being protruded from the mouth. This coughing is an effort on the part of the animals to remove the small thread-like worms which are situated in the smaller bronchial tubes. The symptoms are slight at the onset of the trouble. There is some loss of appetite, an unthrifty appearance develops, and finally the affected animals lose condition. In severe cases in calves the animals often become affected with broncho-pneumonia in the later stages.

In the treatment of this condition in calves numerous agents have been tried with varying success. Injections of various volatile

agents into the windpipe have met with considerable success. This type of treatment should be left to the private veterinary practitioner of the district. A common treatment which is adopted in many dairying districts is the use of chloroform or ether as an anæsthetic. These substances reach the seat of the parasites, and there is little risk, as, even though the animals remain under the anæsthetic for some little time, no harm is done. There is a danger of collapse if advanced cases of the disease affected with broncho-pneumonia are treated in this way. A common method adopted by some farmers is to pour about a teaspoonful of chloroform into the nostril of each affected calf, the calf's head being held so that the calf will inhale it. The parasites are coughed up in the discharges. The most serious aspect of lungworm infestation in young stock—*i.e.*, lambs and calves—is that stomach worms are usually associated with the lungworm in the same class of animal. The common system of feeding calves adopted throughout the country is to maintain a special paddock near the milking-shed, which is known as the calf-paddock. The main advantage in this case is that such a paddock is convenient for the feeding of the calves and some economy of labour in the feeding operations is effected. The permanent use of one paddock as a calf-paddock is, however, to be condemned on account of contamination of the grazing with parasites. If an interchange of paddocks could be arranged so that a fresh paddock would be available for the young stock each year, a considerable reduction in sickness and mortality would be effected. Under the present system the calf-paddock becomes calf-sick and good results are obtained only with considerable attention to improve feeding and management of the stock grazed therein. A calf-sick paddock should be grazed for a season with adult cattle or with horses, and should be limed, or ploughed and sown down in crop. Small weedy calves the constitutions of which are undermined with parasites cannot be expected to develop into healthy robust dairy stock. It is advisable therefore to take measures to build up this class of calf and treat it for parasites so as to enable it to survive the winter.

Evidence of stomach worm infestation in both calves and lambs may be as follows: The skin of the lamb may be of an excessively pale colour and not the usual healthy pink. The wool may be loose and come out easily. The mucous membranes of the mouth and eyes may be very pale. In both classes of stock the animals may show an unthrifty appearance and are likely to be light, undersized, and underdeveloped. If the infestation is a severe one the animals may show evidence of scouring in the later stages. At this stage it is a difficult matter to restore such stock to health. No type of treatment which does not include particular attention to the animal's diet can be recommended with confidence. In the case of calves thus affected the ordinary diet should be supplemented with a ration of crushed oats, linseed, bran, or other suitable concentrate. If the pasture is bare, silage or good quality hay should be provided.

In the medicinal treatment of calves and lambs some preparations have been tried with useful results. In the treatment

of calves for stomach-worms oil of turpentine may be given well diluted in milk. From a teaspoonful to a tablespoonful of oil of turpentine may be given to each calf, according to its size, well diluted in about ½ pint of milk. Lysol and Jeyes' Fluid have been given in medicinal amounts well diluted in some medium such as milk or water or even thin gruel. In many cases the bluestone solution which is used for dosing worm-infested lambs may also be used in the case of calves, the dose being correspondingly increased, depending upon the age and size of the calf. Then there are such drugs as carbon tetrachloride and tetrachlorethylene which are more commonly used in the case of parasites in lambs and sheep. Sheep tolerate these drugs better than cattle, so that turpentine, coal-tar preparations, and the bluestone solution, are more frequently used in the case of cattle. These drugs are usually prescribed when well diluted in liquid paraffin.

For the treatment of both cattle and sheep the following use of bluestone solution has been recommended by this Department: A 1-per-cent. solution of bluestone in water is prepared and the dosage of the stock arranged according to the age of the sheep and according to the age of the calf. A 1-per-cent. solution of bluestone may be prepared by dissolving 1½ oz. of bluestone in 1 gallon of water. The dosage for lambs and sheep is: lambs 1 fluid ounce, hoggets 2 ounces, and full-grown sheep 3 fluid ounces. Each calf may be given from 3 fluid ounces upwards, depending upon their age.

The dosing may be repeated at monthly intervals if considered necessary. In the case of lambs it is advisable to dose at about weaning-time, to be followed at three-weekly or monthly intervals as is found more convenient.

After dosing a change of pasture is desirable and if a rotation of pastures or fattening crops is available so much the better It is most desirable that the feed conditions should be maintained and that the food available should be of an improving nourishing type rather than a deteriorating one. Where rape or barley and later on roots are available these crops serve quite well while they last. On such crops a run-off on grass is always desirable. If, however, such crops are not available and the pasture is poor, an attempt should be made to feed the lambs on some dry feed such as good-quality hay, silage, or a ration of oats or good-quality oaten chaff. Here, leaders will be necessary to teach the young sheep to eat the dry feed.

In all cases of stock infested by parasites rock-salt should be provided. A mineral lick may be provided in the place of the rock-salt, the lick being composed of salt with an addition of from 5 per cent. to 10 per cent. of the iron oxide known as limonite. The management in the rearing of young stock should ensure that the immature animal is kept in the highest attainable state of health during the developmental period. This applies with special force to dairy calves that are artificially fed. An ample margin of safety should be provided against unpredictable stresses—*i.e.*, bad food and inclement weather, &c.

CHEMISTRY OF WEED-KILLERS.

(Continued.)

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A SHORT series of articles(1) published in this *Journal* during 1933-34 dealt with some general principles of the chemistry of weed-killers in relation to the control of ragwort (*Senecio Jacobaea*). More recently a comprehensive scheme of work has been undertaken to confirm and enlarge u on the results obtained from the earlier experiments made in the arch for a substitute for sodium chlorate, which, as previously ointed out, although effective under the appropriate conditions, is dangerous to handle owing to the risk of fire and explosion.

The chemicals employed may be grouped in the following classes: thiocyanates, bisulphites, chromates and bichromates, chlorates and hypochlorites. In continuing the series of articles the additional experimental work will be described and discussed, this particular article being confined to the first group—namely, thiocyanates, sometimes referred to as sulphocyanides or sulphocyanates.

THIOCYANATES AS WEED-KILLERS.

Further trials with thiocyanates were well warranted since they have the distinct advantage that, after the toxic effect has worn off and the weed has been killed, a nitrogenous residue is left in the soil. This acts as a fertilizer and tends to stimulate the regrowth of the pasture after the temporary setback caused by the weed-killer, ultimately leaving a better growth of grass.

Preliminary experiments on ragwort have shown that a 5-per-cent. water-solution of ammonium thiocyanate applied at the rate of from 250 to 450 gallons per acre gave a satisfactory result, as did also to a less extent a 2½-per-cent. solution. Weaker solutions were found to be ineffective and stronger solutions were not justified. Experiments were made to ascertain if smaller quantities of material per acre would be effective and thus lower the cost of treatment for farm practice. Undoubtedly the smallest quantity of solution per acre that can be applied to give complete coverage depends on the type of spraying-apparatus employed. In our work a small "Brown auto spray" pump was used, preliminary tests being made with three kinds of nozzles. The most efficient of these, a heavy brass one, gave complete coverage at the rate of approximately 200 gallons per acre—*i.e.*, 2 gallons of solution just wetting all the foliage on a plot 48 square yards in area. In the subsequent sprayings this nozzle was used throughout. Later in the season, when the ragwort was tall and had reached the full flowering stage, it was not possible to obtain complete coverage with this volume of solution owing to the greater amount of foliage.

Experiments were commenced at the end of October, last year, on fertile alluvial flats at Lower Hutt. The pasture, which was being grazed by dairy cattle, was thickly infested with ragwort in

the advanced rosette stage, averaging from 15,000 to 30,000 plants per acre. In the treatments the entire plots were covered irrespective of the ragwort distribution on the areas. The thick growth of ragwort and the probability of there being numerous small plants hidden in the grass suggested this procedure.

Spraying Trials.

On the 5th November, plots were sprayed with 2½-per-cent., 5-per-cent., and 10-per-cent. solutions of ammonium thiocyanate at the rate of 200 gallons per acre, and one with a 5-per-cent. solution at 400 gallons. This is equivalent to 50 lb. and 100 lb. of material

FIG. 1. LOWER HUTT AREA, SHOWING HIGH DEGREE OF INFESTATION WITH RAGWORT.

per acre for the first two plots respectively, and 200 lb. on each of the latter two. During the first week after treatment the entire plots presented a yellow, bleached appearance, but within three weeks the grass began to recover. After a period of seven weeks, during dry weather, the pasture was still slightly retarded, but at the end of nine weeks, following light rains, it was green, short, and in good condition, whereas that in untreated areas was in a dry, coarse, and rank state.

The results obtained from the latest counts made in the middle of January, 1935, were as follows:—

2½-per-cent. solution at 200 gallons per acre gave an 80-per-cent. kill.

5-per-cent. solution at 200 gallons per acre gave an 80-per-cent. kill.

10-per-cent. solution at 200 gallons per acre gave a 100-per-cent. kill.

5-per-cent. solution at 400 gallons per acre gave a 90-per-cent. kill.

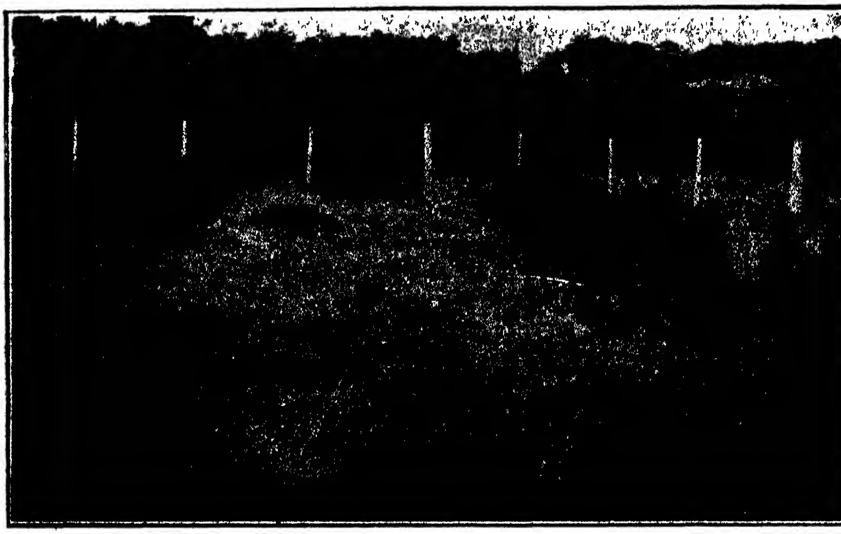

FIG. 2. LOWER HUTT AREA, SHOWING CONTROL PLOTS ON EACH SIDE.
Plot treated with 400 gallons per acre of 5-per-cent ammonium thiocyanate.
[Photo by B. C. Aston

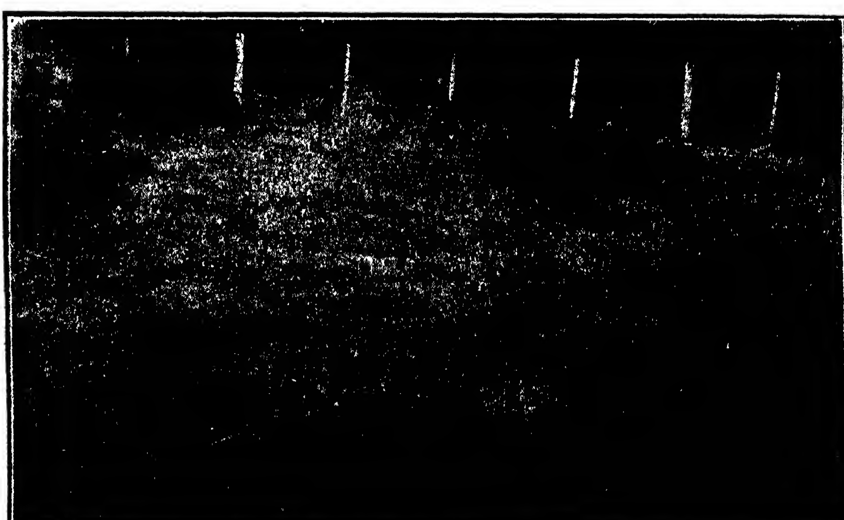

FIG. 3. LOWER HUTT AREA.
Plot treated with 200 gallons an acre of 10-per-cent. ammonium thiocyanate. Control plots on each side. [Photo by B. C. Aston.

It is interesting to note that, of the two plots each receiving 200 lb. of material per acre, the better result was obtained with the one where half the volume of water was used and therefore double the weight of chemical per gallon. This result needs to be confirmed if possible next season, as it may have been induced by peculiar local conditions of soil or climate. An important practical application of this would be that the use of unnecessarily large quantities of water, and the consequent labour, would be avoided.

In the second week of December, in continued dry weather, plots with tall ragwort in the flowering stage were treated with a 10-per-cent. solution at 200 gallons per acre. The results were unsatisfactory compared with the successes obtained in the earlier experiments. The stems appeared dead, but later small green shoots sprouted from the crown of the plants In this instance it was noteworthy that the large amount of tall ragwort foliage on the plot made it difficult to obtain complete coverage with the same quantity of solution used on the younger ragwort.

In addition to the above experiments, Mr. C. R. Taylor, the Chemistry Section's Country Officer at Rotorua, conducted trials with ammonium thiocyanate, using a "Vermorel" knapsack sprayer. He reports as follows :—

> "2½-per-cent. solution gave less than 50-per-cent. kill. Grass returned to normal in ten days
>
> "5-per-cent. solution gave 100-per-cent. kill Grass scorched."

There is no record of the volume of solution applied per acre, but it is assumed that the treatment would be similar to that applied in practice by an efficient farmer. Generally speaking, the Rotorua experiments with thiocyanates, and more particularly with other weed-killers such as bisulphites, chromates, and hypochlorites, were more successful than was the case on the Lower Hutt farm. This may be attributed to differences in soil, climate, stage of growth, or the quantity of solution used.

SODIUM THIOCYANATE

A quantity of crude sodium thiocyanate liquor was given a trial, the material being black, heavy, and of a semi-solid nature It contains 6 per cent. of the fertilizing ingredient nitrogen, a very much less amount than ammonium thiocyanate, which contains 37 per cent. of nitrogen. For the sake of comparison it may be mentioned that sulphate of ammonia has about 20 per cent. of nitrogen. A 7½-per-cent. solution at 200 gallons per acre gave a 60-per-cent. kill, while a similar solution at 400 gallons per acre gave an 80-per-cent. kill. The grass was temporarily retarded, but at the end of ten weeks was in fairly good condition, being better than on untreated adjacent areas, but not so good as was obtained from ammonium thiocyanate treatment.

Mr. Taylor also used sodium thiocyanate, with the following results :—

> "Crude liquor : 10-per-cent. solution very unsatisfactory, giving only 25-per-cent. kill. Grass badly affected.
>
> "Crude fused material : Good at 10-per-cent. solution on ragwort in flower. 5-per-cent. solution unsatisfactory."

The sodium thiocyanate is a very impure, cheap by-product. The results suggest that insufficient allowance was made for the 50-per-cent. impurities present, and that the solutions should have been stronger. However, the table of costs (see page 169) indicates that it would be preferable to use the ammonium salt instead of stronger solutions of the sodium thiocyanate.

Dry Application of Ammonium Thiocyanate.

If ammonium thiocyanate were effective when sprinkled dry over ragwort-infested pasture, it would probably be most economically and conveniently applied in conjunction with the normal top-dressing operation on the farm. Mixing with lime is unsuitable, as this causes loss of nitrogen in the form of ammonia, so in these trials thiocyanate was mixed with superphosphate. The mixture was of a dark red colour, but this did not appear to affect the action of either of the ingredients. Superphosphate-thiocyanate mixtures were made up in lots containing 10 per cent., 15 per cent., and 25 per cent. respectively of thiocyanate, and applied at the rate of 4 cwt. per acre soon after mixing. The distribution was carried out on 2nd November. The plots were 54 square yards in area, and sand was added to the mixture as a diluent to facilitate even distribution when broadcasting by hand.

Following the treatment, the plots presented a bleached appearance for about a fortnight. A report after five weeks indicated that the grass was almost normal, while four weeks later it was green, in striking contrast to the grass on adjacent areas. The treatment containing the smallest quantity of thiocyanate—namely, 10 per cent — was ineffective. The 15-per-cent. treatment gave a 75-per-cent. kill, while the 25-per-cent. plot gave over a 90-per-cent. kill.

Another plot was treated with the same amount of thiocyanate as the plot receiving the 15-per-cent. mixture, but in this case no superphosphate was added. The percentage kill was a little less than the corresponding superphosphate-thiocyanate plot, and the grass did not come away quite so well.

With thiocyanates, as in the case of some of the other weed-killers, the results were compared with those obtained by first cutting the ragwort close to the ground and treating after removal of the foliage. It was thought that this would avoid using large quantities of material on the foliage and enable the chemical to enter the root system by way of the open surface of the cut stems.

The 25-per-cent. mixture was therefore applied to a plot where the ragwort had been previously cut and removed. This was a complete failure, and two weeks later the ragwort was growing with more vigour than previously, as it had been apparently stimulated by the mixture of thiocyanate and superphosphate.

Some Considerations regarding Costs of Treatment.

From the farmers' viewpoint the cost of the treatment would be the limiting factor. The thiocyanates used in our experiments were generously supplied by the Manchester Oxide Co., England. This company originally quoted the price of ammonium thiocyanate at 6d. per pound landed in New Zealand, which, after the addition of

exchange and incidental expenses incurred in selling locally, might possibly enable the product to be made available to farmers at about 8d. or 9d. per pound.

A report of recent preliminary experiments at the Rothamsted Experimental Station, England, refers to experiments and calculations with respect to the fertilizing-value of the nitrogen in ammonium thiocyanate. It was ascertained that when it was applied to soil at even heavier rates than when used for weed-killing purposes most of the nitrogen was converted to nitrates and thus made available for plant nutrition. The fertilizing-value of the contained nitrogen was estimated to be 2d. per pound of ammonium thiocyanate, the calculation being based on the New Zealand price of sulphate of ammonia. After deducting 2d. for the value of the nitrogen plant-food, which where required should be taken into account in top-dressing practice, the price of the weed-killer would be 6d. per pound. However, we understand that the quoted price of the material might in the near future be subject to a reduction of 2d. per pound, thus bringing the final figure down to 4d. per pound. Sodium thiocyanate was originally quoted at 1½d. per pound f.o.b. English ports, but when due allowance has been made for shipping-expenses, exchange, and retailing costs, the chemical could probably be made available at about 2½d. per pound.

The following table has been included to show the price per acre for material to give the results obtained with the various treatments. The calculations are based, in the meantime, on 6d. per pound as being a market price of the ammonium thiocyanate, after arbitrarily allowing 2d. as the value of the nitrogen in the product.

Treatment	Kill.	Cost per Acre. (Materials only.)		
Ammonium thiocyanate—	Per Cent.	£	s.	d.
2½-per-cent solution at 200 gallons per acre ..	80	1	5	0
5-per-cent solution at 200 gallons per acre ..	80	2	10	0
10-per-cent. solution at 200 gallons per acre ..	100	5	0	0
5-per-cent solution at 400 gallons per acre ..	90	5	0	0
Sodium thiocyanate—				
7½-per-cent. solution at 200 gallons per acre ..	60	1	11	3
7½-per-cent solution at 400 gallons per acre ..	80	3	2	6
Ammonium thiocyanate-superphosphate mixture—				
15-per-cent of 4 cwt. per acre	75	1	13	7
25-per-cent. of 4 cwt. per acre	95	2	16	0

With reference to the costs of the material for the spraying treatments, it should be stressed that 200 gallons per acre was the minimum coverage obtainable with our apparatus, and this determined the minimum cost per acre. With a more expensive and efficient pressure pump the cost would be reduced to approximately a quarter by obtaining coverage with 50 gallons per acre. Mr. J. W. Deem, late Director of the Fields Division, in recording(2) ragwort treatment with sodium chlorate, mentions that coverage was obtained at the rate of 420 gallons of solution per acre, using a knapsack spray-pump. However, with a Davis bulk pump he was able to cover an

acre with only 59 gallons of solution. In another instance Mr. Deem describes treating an acre with a 5-per-cent. solution, using 24 lb. of sodium chlorate, which is equivalent to 48 gallons per acre.

In the case of the dry mixtures the cost of the superphosphate was not taken into account. However, it could be assumed that this method would be used only where the farmer had intended to top-dress at the time of ragwort treatment.

Instead of striving for a 100-per-cent. kill it might possibly be more economical to be satisfied with about an 80-per-cent. kill after the first treatment, and then deal with the surviving plants by individual retreatment. It would seem that this could easily be done by spraying or by placing a small amount of dry material directly on the plant. For this purpose one of the other classes of chemicals may be more suitable—*e.g.*, sodium bisulphite, which is cheaper and more convenient to handle in the dry state than ammonium thiocyanate (Bisulphites will be dealt with in a subsequent article, when further detailed results are available.) The application could be made by hand from a bucket or sack, or by using one of the various types of mechanical devices designed for this purpose. These usually consist of metallic cylinders from 4 ft. to 5 ft. long containing the dry weed-killer. When the instrument is stamped on the crown of a ragwort plant, an aperture is automatically opened at the base of the cylinder, and the requisite quantity of chemical is ejected on to the bruised plant, the aperture closing immediately the instrument is raised from the ground. This appears to afford a cheap, simple, and convenient method of dealing with scattered plants.

As previously stated, the spraying activities entailed the covering of the entire plots with solution, and the costs per acre were calculated on this basis; therefore, where the ragwort exists as scattered plants or clumps, the cost per acre of treatment is thus proportionately reduced.

In interpreting the results of the above experiments it should be emphasized that the past summer has been abnormally dry, a factor which appears to be favourable to the success of thiocyanate as a weed-killer. There was no appreciable quantity of rain until eight days after the spraying experiments and eleven days after the dry application. Within four weeks after treatment there were only about eight really wet days. The next month, December, was also very dry; according to the meteorological reports there was only one wet day. This unduly dry season may have accounted for the success of the thiocyanate treatments, and it has yet to be proved whether the results can be reproduced in normal periods.

Properties of Thiocyanates.

The following points are noteworthy in regard to ammonium thiocyanate: When the pasture on the plots sprayed with the material had recovered, cattle grazing in the paddock showed a decided preference for these areas. Mr. Taylor also stressed this point.

Ammonium thiocyanate is a white crystalline substance extremely soluble and readily absorbing moisture from the atmosphere, becoming

moist and inconvenient to handle if left exposed. Hence it is preferable to carry it in tin or wooden containers rather than in bags. It corrodes iron, copper, brass, and galvanized iron, but does not attack aluminium vessels. The kerosene tins and buckets used in our field work were not damaged, but these and the spraying-apparatus should be well rinsed after use. When the thiocyanate comes in contact with rust particles, a deep red colour is produced. This is a harmless reaction and does not alter its weed-killing properties. The material has a shrinking effect on leather, and rubber shoes are best used during operations. It is not combustible or explosive when in contact with organic materials, whereas sodium chlorate forms dangerously combustible mixtures. There is no fire hazard in using ammonium thiocyanate or its solution, and in this respect it is absolutely safe. It has a cold, repellent, salty taste, and, according to Harvey(3), " is not liked by cattle and is not as poisonous as chlorates are to live-stock." Nevertheless, as in the case of top-dressing, it would be a precaution not to put cattle on to treated areas for a few days.

An eminent medical authority in England has expressed the following opinions :—

(1) That the toxicity of sulphocyanides (thiocyanates) is negligible when compared with cyanides, and that even when administered in large doses they would be extremely unlikely to cause death :

(2) That poisoning by sulphocyanides (thiocyanates) is practically unknown, despite the fact that they are used in every chemical laboratory and in industry— *e.g.*, photography :

(3) That they do not give off any poisonous fumes, except possibly at high temperatures .

(4) That the handling of the substances does not call for any special precautions :

(5) That so far as transport is concerned, provided they are packed in airtight containers and stored away from strong sulphuric acid, no possible danger can ensue, and even if a packet became damaged no danger would result from the substances coming into contact with wood, iron, paint, straw, &c.

POSSIBILITIES FOR THIOCYANATES.

The thiocyanates certainly appear to have possibilities as weed eradicants in horticultural practice. Their toxic properties also suggest their thorough trial on gorse, blackberry, thistles, and other highly pernicious weeds. Our experiments in these directions have given some interesting results during the abnormally dry weather prevailing in the summer of 1934-35. For weeds on lawns and garden paths the results have been very encouraging.

As regards ragwort, chances of success with thiocyanates are considerably enhanced if the plants are still in the rosette stage, and, if possible, treatment is made when there is little prospect of heavy rain immediately after application.

Ammonium thiocyanate is a comparatively new substance for the control of weeds, and of ragwort particularly : the best method of application for various localities has yet to be ascertained. However,

it appears that under appropriate conditions it may yet prove to be a successful, convenient, economical, and safe substitute for sodium chlorate and the arsenical compounds, at the same time ultim tely leaving a fertilizing residue in the soil.

Thanks are due to Messrs. M. R. Coup and R. J. Park for assistance in the field work in connection with the experiments discussed in this article, and to Mr. C. Brodie, Lower Hutt, for the use of the paddocks on his farm.

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THE HOST RANGE OF *PHOMA LINGAM*.

ITS SIGNIFICANCE TO SWEDE PRODUCTION IN NEW ZEALAND.

J. G GIBBS and R. M. BRIEN, Plant Research Station, Palmerston North

THE dry-rot organism (*Phoma lingam*) was recorded in New Zealand on swede, turnip, and cabbage by Cunningham (1927). No additional hosts were recorded until Neill and Brien (1933) secured the organism from chou moellier and rape. In February, 1934, *P. lingam* was isolated from a stem canker on a wild turnip plant (*Brassica campestris*) and the following May from leaf-spots on rape, cabbage, and cauliflower seedlings.* These latter plants were grown beside infected swede seedlings while the wild turnip grew in a rape crop on land which the previous season had produced a dry-rot infected swede crop.

EXTENSION OF HOST RANGE.

Experiments were carried out to determine whether cruciferous weeds and garden plants are capable of carrying infection.

Inoculations with a single spore culture of *P. lingam* strain IIB were made by (*a*) spraying plants with aqueous spore suspensions, (*b*) by injecting spore suspensions between the leaf surfaces with a hypodermic syringe,† and (*c*) in two cases by inserting mycelium into incisions in the stems.

Using method (*a*) spore suspensions were sprayed on (i) seedlings in the glasshouse; (ii) young potted plants placed for forty-eight hours in an incubator at approximately 21° C. and 100 per cent. relative humidity; and (iii) on mature plants growing in the glasshouse. In this series positive infection developed only on

* Strain IIB was obtained from cabbage, cauliflower, and wild turnip, and strain IIA from rape.

† Slight blistering was caused by the injections, but this did not appear to injure the leaves of non-susceptible plants.

mature plants, but by the hypodermic method infection was secured on the leaves of young plants in May, and of flowering plants in June, strain IIB being isolated from the lesions in all cases.

In the following table are recorded the results of inoculations and also the general distribution of the plants in New Zealand.

Table 1.—Inoculation of Cruciferous Plants with P. lingam.

Plant inoculated.	Results of Inoculations.				Distribution in New Zealand.
	Spray.	Hypodermic		Stem Insertion.	
		17/5/32.	20/6/32.		
Arabis albida	—	+	+	..	Cultivated.
Alyssum calcineum	—	—	—	..	,,
Barbarea stricta	—	—	—	..	W G
,, verna	—	—	—	..	,,
,, vulgaris	—	—	—	..	,,
Brassica arvensis†	+	—	+	..	,,
,, campestris*† ..	—	+	+	..	F.
,, oleracea	+	+	+	..	W. Coast
Capsella-bursa-pastoris† ..	—	—	—	..	F.W.G.
Cardamine heterophylla ..	—	—	—	..	Forest.
Cherianthus cheri	—	+	+	..	Cultivated.
Coronopus didyma	—	—	—	..	F.W G.
,, procumbens ..	—	—	..	..	F.W.
Diplotaxis muralis	+	+	+	..	G. Coast.
,, (Siliquas) ..	..	..	+	..	,,
Lepidium ruderale	—	—	—	..	F.W G.
,, campestre	—	—	—	..	F
Matthiola incana†	—	—		..	Coast
Raphanus sativus	—	—	+	..	W.
Sisymbrium officinale ..	—	—	—	..	F.W G
,, orcintale ..	—	+	+	..	G.
,, sophia	—	—	—	..	W.
Cultivated plants—					
Cabbage stems†	—	..	..	+	Cultivated.
,, leaves*†	+	—	+	..	,,
Cauliflower*†	..	..	..	..	,,
Chou moellier*	—	+	+	+	,,
Rape*†	+	..	+	..	,,
Swede bulbs*†	—	+	+	..	,,
,, leaves*†	..	+	+	..	,,
Turnips*†	—	..	..	..	,,

NOTE: + = Infection by *P. lingam*; — = No infection produced. Distribution of weed plants (F. = Field; W. = Wayside; G. = Garden). * = Hosts on which *P. lingam* was collected in the field in New Zealand. † = Recorded as hosts of *P. lingam* overseas (Henderson (1918) and Buddin (1934).)

SIGNIFICANCE OF HOST RANGE.

In New Zealand field infection of crucifers other than swedes and turnips is rare, and appears to be associated with infected root crops or to occur on land which carried a diseased crop the previous season. The possibility of chou moellier, rape, cabbage, or cauliflower introducing the disease to root crops seems remote, as *P. lingam* has been secured but twice on these hosts since 1927. Of the weed hosts, only wild turnip is common to farm-land. This plant may possibly introduce the disease to root crops; but, as commercial growers in New Zealand avoid districts in which wild turnip is present, it is unlikely to carry infection to seed crops. The remaining hosts are scarcely likely to be of significance

in introducing dry-rot to swedes or turnips since they are either rare or of limited distribution, and, as yet, have not been found naturally infected.

FIG. 1. TYPICAL P. LINGAM LESION ON RAPE-LEAF: X1.
[*Photo by H. Drake.*

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INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 7th February to 21st February, 1935, include the following of agricultural interest:—

No. 71436: Removing gases from milk; T. E. French and the Aluminium Plant and Vessel Co., Ltd. No. 72080: Teat-cup; H. F. Taylor. No. 72265: Insecticide, E. Hope. No. 71912: Harrow; P. D. Tennent. No. 72031: Milking-appliance; G. H. Gascoigne and J. R. Knox. No 72301: Milking-machine pulsator; T. Shiels. No. 72334: Meat-carrier rail; A. S. Parker. No. 72575: Agricultural implement; G. T. Zohrab.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

PROGRESS OF THE CONTROL OF THE WHITE BUTTERFLY BY *PTEROMALUS PUPARUM.*

J. MUGGERIDGE, Entomologist, Plant Research Station, Palmerston North.

THE white butterfly at the present time may be found in most parts of the North Island, and is also beginning to make its presence felt in parts of the South Island.

During the past year the Department of Agriculture bred up large quantities of parasites in order to start colonies in those parts where the butterfly is present and where no parasites had previously been liberated.

The butterfly first became prevalent in Hawke's Bay, and it was in this locality that the natural enemies were first liberated. In January and February of 1933 the first consignment of *Pteromalus puparum* was liberated at Maraekakaho, near Hastings. In the 1934 season further supplies of this parasite were liberated at Maraekakaho, and towards the latter part of this season field investigations indicated that the parasite was spreading rapidly from the initial point of liberation and was commencing to exercise a fair amount of control. Field investigations for the current season indicate that the work of the parasite is outstanding in that the Hawke's Bay infestation at the time of writing has been reduced to such an extent that comparatively few butterflies are seen, though no doubt they exist in fair numbers in restricted areas. In other parts of New Zealand, notably from Wellington right along the coast to New Plymouth, the butterfly has been able to multiply unchecked and consequently large areas of crops are being destroyed, and many in this area are beginning to wonder whether the parasite is of any value. It must be understood clearly that, on account of the enormous population of butterflies, some considerable time must elapse before the parasite begins to overtake its host, since apart from a few that were liberated around Palmerston North, Marton, and Fordell no individuals of *P. puparum* were distributed in the Wellington and Taranaki districts before the current season

Some farmers seem to be under the impression that all that is necessary is to obtain parasites from the Department of Agriculture and liberate them on the crops, and that by some magic the butterfly will disappear. Unfortunately this does not happen, and it is only after the parasite has had sufficient time to breed and multiply into large numbers that the effect of its presence will be properly felt.

During this season the Department, from its comparatively small stocks of material, can hope to establish initial parasite colonies only, from which it is confidently expected the parasites will spread successfully, and, after a season or so, breed in sufficient quantities to exert the control desired. Up to the present 550,000 parasites have been sent out. Large colonies of these have been distributed on crops which it was felt were suitable from the point of view of parasite-establishment.

In Hawke's Bay during two seasons two colonies of ten thousand parasites were liberated in the one locality, and a good control is being obtained. Many more colonies greater than this number have been liberated over other parts of the North Island generally, so that it is reasonable to expect that towards the end of next season, or some time in the season following, a satisfactory degree of control will be obtained in infested areas generally. Too hasty judgment on the efficiency of the parasite should be avoided, since experience

in Hawke's Bay leads one to expect confidently that the same satisfactory control as in Hawke's Bay will be eventually secured in other areas where the parasite becomes established.

SEED-WHEAT CERTIFICATION.

CERTIFIED CROPS.

UNDER the Government scheme for the certification of seed-wheat, the following growers have seed for sale from crops which have passed both field and grain inspections. (A previous list, to which purchasers are referred, was published in the February *Journal*.)

Variety.	Grower.	Acreage.
Cross 7	*†Blackwater Estate, care of H. Neave, Leeston	18
	*Canterbury Seed Co., Leeston	22
	*†J. O'Boyle, Lakeside	10
Hunters II	*Canterbury Seed Co., Leeston	18
Solid Straw Tuscan ..	‡A. Allen, Killinchy, R.M.D., Leeston ..	12
	H. Oliver, Hororata	11
	T. Pascoe, Halkett	10
	T. E. Pearson, Hororata	30
	‡J. S. Templeton, 238 Lincoln Road, Halswell	10
	Estate of J. Barclay, Mount Hutt Rural, Rakaia	40
	R. E. Cairns, Mount Hutt Rural, Rakaia ..	8
	C. Chamberlain, R.M.D., Winchmore ..	20
	L. A. Maidens, R.M.D., Winchmore ..	40
	Westgarth Bros., South R.D., Kingsdown ..	10
Dreadnought 5/27 ...	J. Kinnimont, Kauru Hill	10

* Passed subject to machine dressing of seed. † Contract to Canterbury Seed Co.
‡ Portion of line passed subject to machine dressing.

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Importance of Top-dressing.

WHILE the continued relatively low level of prices of farm produce generally makes it necessary to keep down expenditure as much as possible, it is very desirable to avoid passing beyond the borders of true economy into the state of unwise parsimony. Experience has shown that this passage from economy to parsimony can readily take place in top-dressing, and it is significant that certain farmers who partially or wholly curtailed sound top-dressing programmes in recent times under the stress of the difficult conditions in farming have already reverted to the former freer use of fertilizers on their pastures. It may be said definitely that generally, the wisest course lies in the carrying-out, in the coming few months, of a top-dressing programme, greater than has been adopted at any time in the past. There is abundant evidence not only that top-dressing widely may be employed to improve the farm position, but also that if it is not so employed, the position frequently will not remain stationary, but will become steadily worse. Discontinuance of top-dressing is not always associated immediately with falling off in farm production, but it seems to be associated with immediate commencement of deterioration in the quality and vigour of the pastures. Normally this deterioration is gradual at the outset on account of the residual effect of manures applied previously and, because it occurs gradually, the deterioration at times escapes notice for a period, but in the second season, without top-dressing, it usually becomes obvious even to quite casual observers, because there is a marked change in the character of the herbage—frequently rye-grass and cocksfoot decline while such plants as brown-top and flat weeds increase in prominence and vigour.

Normally any successful system of regular top-dressing results in increased amounts of farm produce removed from specific pastures, and this is associated with increased removal of the substances supplied by fertilizers. But the increase in the amount of these substances removed from the land as the result of top-dressing is never as great as the amount of these substances supplied to the land by top-dressing. For instance, the increase in the lamb-crop due to top-dressing does not contain as much phosphate as is supplied in the prior top-dressing. It follows from this that normally top-dressing creates reserves of fertility which represent part of the current capital value of the farm, and a type of management which draws upon these reserves without replacement simply means operating upon capital instead of upon income. From these facts it may be deduced that a farmer, in considering his top-dressing programme, should be influenced, not only by the extent to which a given amount of fertilizers will increase the production of his pastures in the coming season, but also by the amount of prospective decline in production, say two seasons hence, if top-dressing is not carried out. And intelligent drafting of top-dressing programmes should take into account the fact that, while there has been a substantial decline in the price of farm produce, there also has been a substantial decline in the cost of fertilizing substances in the same period.

Phosphatic Top-dressing of Prime Importance.

Almost invariably the first result to be sought in top-dressing is strengthening the supply of available phosphates. Accumulated experience in the field well justifies the very general use of superphosphate which gives

superior results under low-rainfall conditions, and which generally at least equals, if it does not excel, other phosphatic manures where the rainfall ranges from moderate to high. Of the phosphatic manures, superphosphate most quickly brings about additional growth ; the duration of its influence is far from being as short as is sometimes suggested—which is illustrated by the fact that substantial benefit from superphosphate has been noted to continue after twelve months and more from its application. Further, superphosphate does not cause any permanent increase in the sourness of the soil and extensive field experience shows that, normally, repeated use of superphosphate on the same land is associated with increased fertility which is reflected in improved appearance and production of pastures. Over wide areas with fairly heavy rainfall basic slag is known to give good results, and in districts of good rainfall the various Island and African phosphates may be expected to prove satisfactory.

Use of Nitrogenous Manures.

Especially when there is a prospect of a shortage of winter feed, it may prove profitable to apply a soluble nitrogenous manure such as sulphate of ammonia in late March and April, at the rate of about 1 cwt. an acre. The use of such a nitrogenous fertilizer alone is seldom satisfactory, and, usually, to obtain satisfactory results, phosphates should be applied at the same time, as, or shortly before, the nitrogenous material, and frequently the fullest benefit from the use of sulphate of ammonia is also associated with recent liming. The best effects from nitrogenous manures as a rule result from their use on vigorous, well-drained pastures in which rye-grass is prominent.

Liming.

In New Zealand liming of grassland has produced very diverse visible results ; sometimes liming is clearly advisable and sometimes it has no apparent influence. In view of this, expenditure on liming should not be made on the basis of mere surmise or tradition, but should be justified by real evidence of success attending its use under circumstances similar in essential respects. Those seeking to reduce their outlay on top-dressing at times resort to lime as a cheap substitute for phosphates. This is seldom financially attractive for, while there is a considerable area on which a mixture of lime and superphosphate gives good results, the area on which the results from lime alone are satisfactory appears to be very restricted. As a rule, if standard dressings of phosphates have not a satisfactory influence, then lime in association with phosphates is well worth a trial on the land Apart from field trials, no methods of ascertaining the amount of lime that may be applied to land profitably have been shown to be reliable to any considerable extent.

Autumn Management of Grassland.

Widely, autumn harrowing of pastures is very desirable, and it should be thorough enough to bring about even distribution of droppings, which, when suitably broken up and scattered are of considerable fertilizing value, but which, if left undisturbed, bring about deterioration instead of improvement of the sward, and magnify the task of efficient grazing management.

At times young pastures deteriorate rapidly because of an initial lack of fertility, and, as a rule, it is much better to prevent this by suitable top-dressing in good time than later on to renew or repair deteriorated swards. Hence, in conditions in which top-dressing is of known value, a special effort should be made to top-dress newly established pastures.

Provision of Feed for Winter and Spring.

Over wide areas, the recent widespread and welcome rains have brought a welcome change in the growth and the colour of pastures. In regard to feed for the coming winter and spring, this change seems to have given some farmers an unjustified feeling of security. While the additional growth resulting from the recent rains is most valuable as a means of maintaining the stock in good condition prior to the comparatively severe winter and spring period, it should be remembered firstly that many farmers are facing the period mentioned with unusually low reserves of feed; secondly the feed produced by pastures between now and winter is not likely to be so substantial as present appearances might lead one to expect, because the current warm conditions that beget rapid growth are likely to disappear in the normal manner, and thirdly that in any case, the growth made under the current conditions is likely to be of a lush immature character, and to lack the value for winter-feeding that attaches to the more mature herbage customarily available for winter. Because of these facts, much reliance clearly cannot be placed safely upon the feed resulting from recent rains, and crop production fitted to strengthen the weak feed position generally should be proceeded with as quickly as possible. One of the most important steps that still may be taken in this respect is the sowing of cereals: if feed is definitely desired as quickly as possible, then barley or white oats should be sown, but in districts in which white oats are subject to severe attacks of rust, they should be grown only if it is intended to use them simply as a catch crop for green feed, and not to let them develop eventually into a grain or chaff crop When early feed is not desired specially, Algerian oats which rightly are popular for green feed, may well be sown; they can be fed off and then allowed to grow to yield good chaff. Algerians successfully can be fed off with great severity, but Gartons should be eaten down once only and that quickly Oats for winter and spring feed and subsequent grain or chaff production should, if possible, be sown not later than April or early May, and usually it will prove profitable to fertilize with from 1 cwt to 2 cwt an acre of superphosphate, while, if the crop is to be grown on land exhausted to some extent by previous arable cropping, it may be profitable to use ammoniated superphosphate so as to assist in creating a correct supply of nitrogen In sowing oats in the autumn for feeding off and subsequent grain or chaff production a seeding of from 1½ bushels to 2 bushels an acre is popular, while in sowing oats for green feed alone, as a catch crop, a seeding of 2½ bushels an acre may be expected to give good results. When oats are sown broadcast failures which occasionally occur are sometimes attributed to poor seed, when really they are due to inadequate covering of the seed facilitating depredations of birds Barley, which is of distinct value for early green feed—*e.g.*, in May—is sometimes used for spring green feed for which it does not yield as well as oats, and if the barley is fed when running to seed it may cause digestive disorders in stock.

In order to build up the maximum possible supplies of winter feed, steps should be taken to turn into silage or hay, before injury by frost has occurred, any available green maize or millet. Because some difficulty may be experienced in drying the coarse herbage satisfactorily, silage should be made in preference to hay if the amount of green material available is not so small as to lead to undue wastage in ensilage. In ensilage wastage occurs almost wholly at the surface, and in small quantities of crop the amount of surface is proportionately high.

In using cereals for green feed, apart from the prior reference to Gartons oats, better results are obtained usually by feeding off two and three times when the growth is not very tall instead of waiting until there is tall growth, which not only is likely to bring about relatively

heavy wastage by trampling, but may lead to a poor second growth. Swedes attacked to a considerable extent by dry rot should be utilized without any avoidable delay.

In some instances the unfavourable season has upset plans for the provision of winter feed for pigs, and farmers are exploring the possibility at this stage of growing crops specially to meet the winter needs of pigs. It is impossible generally at this season to begin the production of crops fully satisfactory for direct use by pigs. However, especially when it is a case of making provision for fairly mature pigs, such as sows and boars, indirect measures may be taken by growing the cereal crops already mentioned, feeding them to the cows and thereby increasing the amount of fresh leafy growth available on the pastures for the pigs.

General Cropping Work.

In the main South Island wheat-growing districts, autumn and early winter prove the ideal sowing season for wheat which fares best on a fine firm seed-bed. Extensive experimental work has shown that over a wide area wheat responds profitably to a dressing of 1 cwt. of superphosphate to the acre, and as the experimental work has been fully confirmed in farm practice, the manuring of wheat in conformity with the findings of systematic investigation rightly is becoming standard practice.

Commonly occurring smuts of wheat, oats, and barley may be controlled effectively by suitable inexpensive treatment of the seed prior to sowing, and yet these smuts annually cause substantial losses in the crops of the Dominion. Probably the neglect regarding smut control is greatest in the case of oats, partly because there is a tendency to ignore the undesirability of smut in oats harvested as chaff. Seed treatment, if not suitably carried out, is very likely either to be ineffective in controlling the smut, or to lead to serious damage to the treated seed. Within recent years, the introduction of such materials as copper-carbonate and organic-mercury dusts has added to the convenience and simplicity of proper seed treatment. Full particulars of approved methods of the treatment of cereal seed are given in this *Journal,* July, 1934, and also may be obtained from the officers of the Fields Division in the various districts.

The preparation of the seed-beds of autumn-sown cereals is at times not as thorough as is desirable. Clods on the surface of such seed-beds are desirable rather than undesirable, because they tend to provide shelter for the seedlings and to check the setting of the surface layer of soil into a hard layer, but below the surface fineness and firmness in the seed-beds is desirable. Because of the desirability of firmness in the seed-bed for wheat, it is at times possible to dispense with ploughing when wheat is to follow potatoes or peas, thorough disking being sufficient. When wheat is to follow pasture skim-ploughing should be done early in the autumn, and if it has not already been done it should be carried out as soon as possible. After the skimmed furrows have had the benefit of from six to eight weeks weathering, they should be disked and the land then ploughed to the full depth.

Autumn treatment of lucerne at times is of importance. The growth made during the latter part of the season occasionally is grazed. Because such grazing necessarily involves trampling, which definitely favours the entrance of grass, it is usually inadvisable in the interests of the lucerne, and this particularly applies to districts of good rainfall in which grass may become such a strong competitor as to be one of the worst weeds affecting lucerne.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Late Spraying.

AT this period of the year operations in the orchard are confined mostly to harvesting and preparing for market the crop of pome fruits. It is during this busy period that the control of certain pests and diseases is sometimes not given the necessary attention. A close watch should be kept on late varieties of apples and pears in order to guard against late infection of black - spot and pear - scab in particular. Early autumn rains, which have been experienced in many localities during the present season, favour the development of these diseases. Immediately infection is noticed it is wise to spray with lime-sulphur 0·083 per cent. plus colloidal sulphur 2 lb to 100 gallons of spray. Lead arsenate at a strength of 1½ lb. to 100 gallons should be added to this spray for the control of leaf-roller caterpillar. For pears Bordeaux mixture 3–4–50 plus lead arsenate is recommended.

Fruit Export Work.

Reports from several districts indicate that the fruit is maturing earlier this season than in the average season, consequently where this condition is observed picking-dates should be advanced accordingly. It should be borne in mind that over-mature fruit, if exported, cannot be expected to arrive at its destination in a satisfactory condition. Fruit that has passed the suitable stage of maturity for export, even though it may be packed some time prior to the closing-date for the variety concerned, is certain to be rejected by the inspectors. Any line of fruit that has reached the border-line between mature and over-mature should have the larger sizes withdrawn and only the smaller sizes submitted for inspection. Many varieties of fruit picked before fully developed are inclined to wilt during transit, and fail to develop the true and full flavour of the variety While this condition is to be carefully guarded against, to maintain the good reputation of New Zealand fruit on the overseas markets, it is possible that even greater damage to the reputation of our fruit and lower market realizations would result from the export of over-mature fruit.

Cold Storage for the Local Market.

Storage rots each season take a heavy toll of the fruit held in cool stores. This loss could be considerably reduced by more care being taken in the various handling operations Many of the fungus diseases responsible for storage rots can enter the fruit only when the skin has been broken. Consequently the greatest possible care should be taken in grading to exclude all fruits showing even a minute rupture of the skin. It is important to have the fruit, particularly pears, placed in cool store as soon as possible after picking.

Ordinary Storage of Fruit.

The practice of keeping apples and pears in ordinary storage to prevent placing them on a glutted market is quite satisfactory with many of the late varieties. Fruit for such storage should receive the same careful grading and handling as for cool storage Conditions suitable for the storage of fruit are a cool and even temperature with moderate ventilation. Fruit stored in cases under dense evergreen trees and covered with loose sheets of corrugated iron often keeps in an excellent condition. The drawback to this form of storage is the difficulty of preventing damage by rodents. Fruit exposed to excess ventilation is inclined to wilt, whereas insufficient ventilation encourages the development of storage rots. When left on the ground for any appreciable period the flavour of fruit is often found to be affected adversely.

Care of Budded Trees.

All buds should be examined about three weeks after they have been inserted. If the bud is then showing signs of wilting, it is practically certain that it has failed to take. A further bud can often be inserted with satisfactory results, at this time, even though the trees may have ceased growth. Bands which have not been cut should be watched, and any tendency for them to cut into the stock should be prevented by cutting the tie along the branch on the side opposite to the bud.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

The recent rains following the lengthy hot dry spell will cause the trees to throw out much new growth, which will be soft and tender, and likely to suffer injury from frosts during the winter. Therefore nitrogenous fertilizer should not be used, as it will tend to make the growth more succulent Potassic or phosphatic fertilizers are the safest to use at this juncture, as they will have a hardening effect and will in some measure help the trees to withstand the winter.

The soil will now be in a good condition for the sowing of a cover crop to be ploughed in later in the season. As some fertilizer will be of assistance to the cover crop the sowing of the seed should coincide with the autumn application of manures. Lupins, peas, beans, and tares all produce a fair volume of green material for ploughing under. When working the soil prior to the sowing of cover crops, care should be taken to make a slight slope away from the trees to prevent stagnant water from accumulating near the roots, as it is injurious to the root system of the trees.

This period of the year, while the crop is developing, is a good time to overhaul the trees. All exhausted wood and "water" shoots should be removed and the lower branches shortened to keep them clear of the soil. During the autumn rains there is a danger of brown rot infection If the branches are trailing the warm moist soil does not become dry readily and the spores of brown rot developing on the soil will rapidly infect the fruit and foliage. Spraying the trees with Bordeaux, 3-4-50, as recommended in last month's notes will assist in controlling the brown rot.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Winter Eggs.

As the season of dear eggs is now at hand, this is a critical period for the poultry-keepers, for upon the proper management of the pullets depends largely the profits to be secured at this period of the year. The production of eggs during the winter season is quite artificial, and therefore the pullet bred out of her natural season must be treated in an exceptional manner if eggs are to be produced in good numbers during the season of high prices. If bred at the right season and managed to the best advantage up till now the pullet should now be laying or on the point of laying if conditions are favourable.

There must be no weak link in the chain of management. The reason why some poultry-keepers fail and others succeed in securing eggs when these are most valuable is because in the one case some essential factor in management has been neglected, while in the other case the birds have been handled to the best advantage throughout. These remarks apply to the artificially bred high-type layer, bred to lay when we want her to and not when nature dictates. If any evidence is required to indicate the

necessity of this special care of the laying fowl in the season of dear eggs, it surely is contained in the fact that notwithstanding the greatly increasing number of record egg-laying stock distributed throughout the country and hatched (by artificial means at the right time), eggs still command a high price at certain seasons: certainly much dearer than they would be if all the birds, or even the half of them, hatched to lay now, were doing so This emphasizes the fact that a big percentage of these birds has not been properly managed. Apart from the management of the pullet intended for winter egg production, it is realized that the farmer, or his wife, who has studied egg production on right lines, experiences a greater difficulty every year in securing the necessary broody hens to have a desired number of pullets hatched out at the right season for the production of dear eggs, for the more the egg-yielding power of the flock is improved, the greater becomes the tendency for the brooding instinct to diminish. Because of this it is often advisable either to use an incubator or to purchase day-old chicks, or pullets when from ten to twelve weeks old. The latter, bred from reliable stock, may now be purchased at moderate prices and this method of stocking may be recommended to those small producers who have not the time or do not feel disposed to undertake artificial methods of hatching and rearing chickens The difficulty, of course, will not be so great with the heavier breeds, but even if the laying strains of these be secured, and they are the only types worth keeping, the question of securing broody hens will become almost as great as with the special egg-producing breeds, such as White Leghorns Indications are that the time is fast approaching when hatching and rearing by natural means will be almost eliminated from successful poultry-keeping, and while it is the specialists, now incubating only by artificial means, who produce the great bulk of the winter eggs, probably before many years are past it will be the small settler on the land who will be responsible for the main supply Before this comes about, however, the methods of the specialist will have to be adopted by those to whom poultry-keeping is a side-line If the pullets are to produce a maximum yield of winter eggs, they must be hatched neither too early nor too late. The birds that may generally be depended upon to produce best are those hatched in September for the light breeds and a month earlier for the heavier Having pullets hatched at the desired period, however, is by no means a guarantee that a good supply of winter eggs will be secured, but is only one essential requirement. The subsequent management, especially at the commencement of the laying period, when everything in nature is against the bird laying, is equally important.

Although hatched at the right time and well managed up to the laying period, many pullets go into a moult just when high prices for eggs are expected This may be due to several causes—viz., insufficient food, inferior food, and too many changes in the system of feeding—as well as the most common cause—change of quarters. If the pullet is to attain the highest possible production everything must be done in a proper manner and at the right time In the first place it is important to have the young birds well settled down in the house they are to occupy during the winter, before they commence to lay. This not only prevents their going into a partial moult with the adult stock, but also is the best means of securing eggs in the season of scarcity. The birds should be fed in the house at all times, provided the house is as roomy as it should be, and the floor well covered with litter, in which the whole grain ration should be provided This will induce the birds to scratch and hunt for the hidden grains. Exercise is of special importance at this period of the year where the winter laying pullet is concerned. It is only the pullet provided with dry conditions underfoot that can possibly give her maximum egg-yield during the winter months. Standing about in a yard on a cold wet morning waiting for the morning meal does not encourage egg-production. Above all it is well to make sure that the food supplied to the laying pullet is of the best possible quality, irrespective of cost With

any class of poultry stock, it is false economy to give inferior food because it is cheap. Especially is this the case with pullets at this period of the year. They will simply refuse to eat such food unless, of course, forced to by hunger which naturally results in a decreased egg-yield. Remember that one egg in winter is worth two in summer and that any additional cost in feeding in securing this out-of-season product is more than repaid by the increased price received for it.

The Breeding Cockerel.

On all well managed plants already a rough selection will have been made from the early hatched cockerels, with a view to keeping on the plant the best specimens for future breeding purposes. This is as it should be, for it is seldom that a late-hatched bird proves to be a desirable sire. While the hens for the breeding-pen should be as good as possible, no care is too great in the selection of the male bird. It should be remembered that the male is more than half the breeding-pen, as he leaves his influence on every chicken hatched from him. In the selecting of males for future breeding purposes at this period of the year it is always a wise course to select about double the number of birds that actually will be required for the next season's breeding-pens, for the reason that even the most promising specimen later may develop some serious defect or weakness which would condemn it as a breeder Unless due allowance is made by having a good number for final selection, annoyance and disappointment is apt to be met with when the next breeding-season comes around. In this important work the necessity of giving first consideration to points indicating health and vigour cannot be urged too strongly. The chief signs of health and vigour are a bright prominent eye, face free from feathers, good bodily development, especially in front, wide across the back, tight feathering, sturdy legs set wide apart, and generally an alert active carriage. One should always beware of the extremely early maturing male. During the early stages it may catch the eye as a pretty little bird, but it usually remains a pretty little bird, and being a diminutive specimen it should not be bred from. Usually it is the slowly maturing cockerel of big frame and having the characteristics indicating health and constitutional vigour which makes, in the long run, the best male to head a breeding-pen. In addition to the points mentioned an endeavour should always be made to select birds conforming to breed type, or in other words to the standard requirements of the breed they represent. This, however, is not to say that if a bird generally conforms to the desired points indicating usefulness it should be rejected merely because it possesses some minor breed defect. While feminine characteristics should be looked for in the female, the sire particularly should be at the other extreme, though coarseness should always be avoided. It is desirable in poultry-keeping to neglect no detail in regard to exercise, cleanliness, proper housing, feeding, and general management, but with the cockerel intended for next season's breeding-pen this attention to detail is imperative.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Autumn Operations.

By the time these notes are in print beekeepers will be fully occupied in doing the last of their honey-extracting and preparing their colonies for the winter. Should the autumn be mild, final extracting may be later than usual on account of a prolonged flow of nectar. Thistles will probably yield more nectar than other plants, and will, when mixed with clover or catsear, produce a white, clear, and delicately flavoured honey which forms a splendid article for export.

Should late extracting be necessary, great care must be taken to check robbing: an apiary may soon become demoralized if precautionary measures are not taken. When once robbing starts it may prove a difficult matter to stop. Thousands of bees may be killed by endeavouring to enter the wrong hives, and thereby the strength of the colonies be very much weakened; or the colonies may even be rendered incapable of going through the winter. When robbing has commenced, it is most inadvisable to open any more hives until the trouble is controlled. This may be done by syringing with water the offending hives, and in bad cases by placing wet grass over the entrances until the disturbance has been quelled. On no account should combs of honey be left open to attack, or a hive kept open an instant longer than necessary. If the colony attacked be weak, it is advisable to contract the entrance in addition to the above-mentioned precautions It may be necessary to suspend work in the apiary during the day, doing as much as is thought advisable in the early morning.

Foul-brood.

At all times of the year foul-brood is a menace to the beekeeping industry, and it is advisable always to keep a sharp lookout for any symptoms of it. This is especially the case during the spring and autumn months; and before pronouncing any colony fit for wintering the brood-nest should be examined carefully for the slightest sign of the disease. If a trace is discovered, or the disease is found in a more advanced state, judgment must be used as to the advisability of destroying the colony completely or of treating it.

Winter Stores.

As advised last month, it is well to determine the quantity of stores available in the hives for winter consumption. A plentiful supply is sound economy, and my advice is that not less than 30 lb. of honey be left in each hive. There are occasions when late swarms have not gathered sufficient for their own wintering purposes, and then they must be fed either with clean, healthy honey, or with sugar-syrup. One should never use honey from an unknown source.

Cleanliness and Order.

Before finally leaving the hives for winter it is a good plan to scrape the bottom-boards free of all the rubbish that has accumulated during the summer, thereby helping to keep the bees in a healthy condition, and also to scrape the alighting-boards clean, and to clear any long grass surrounding the hives, as this will tend to keep away dampness. The hives should be placed on blocks several inches off the ground, and in a sheltered position where they may receive a considerable portion of the day's sunshine. Any leaky covers or split supers should be removed from the hives, and sound ones put in their place. It should be remembered that bees require dryness and warmth.

— *E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Season 1934–35.

THE weather has been comparatively hot and dry for an unusually long period, with the effect upon the crops that might very well be expected. Land which lay in a warm dry position practically "went out of business" after the early crops were gathered, and cooler districts enjoying a good water-supply will have to supply the market with winter crops. Where tanks can be securely placed a small motor and pump may accumulate a

sufficient supply that is applied by gravitation as required: otherwise a powerful motor and pump of the requisite capacity are necessary to make a direct supply. The water dam or cistern is little used in this country, but in warm localities apt to run short of water it is worthy of consideration: the amount of water that may be obtained from a comparatively small catchment area is somewhat surprising—the problem is to store it securely.

As was to be expected under the weather conditions, insect pests attacked the crops to a greater extent than fungous diseases. There is a general tendency to blame the white butterfly for all insect damage. As a matter of fact, the caterpillars of two native moths were responsible for quite a lot of damage. They are *Plusia chalcites* and *Mecyna maoralis*. The former is rather a handsome moth, with shaded dark brown velvet wings ornamented with metallic-like plates: in the caterpillar stage when it attacks especially bean and tomato crops its colour is pale green and yellow in longitudinal stripes. The speckled larvæ of *Mecyna* are less common, but when they descend on a plant of kowhai, of which they are very fond, the plant is suddenly defoliated before one has realized that the attack has taken place: this is due to the great number of caterpillars and their restless energy. At the slightest disturbance they drop to the ground and are out of sight among the litter in a moment, thus creating a feeling of false security in the mind of the owner, when, as a matter of fact, their activity is such that they are very soon back again to complete the work of destruction unless steps are taken to protect the plant. Fortunately a light dusting or spray of arsenate of lead will destroy these and all other kinds of caterpillars most effectively, but it is necessary to keep a sharp lookout, especially in fine weather which is so much to their advantage

Again, as was to be expected, tomato crops suffering from lack of water had the fruit affected with blossom-end rot, which is not due to any specific organism. In some instances a surprising quantity of fruit was rendered useless by the development of this condition. Where the water-supply was sufficient crops were heavy, except for the destruction of a percentage of plants by spotted-wilt disease. This virus disease causes the young leaves to develop suddenly a bronze sheen and stops the growth; it was most active about mid-summer. As it is considered to be spread by the agency of thrips, one can understand why it is prevalent in a fine season. These insects are elusive, and it is doubtful if they are present in very large numbers; but the damage they may do is so impressive that they must be regarded in a new light. They are not sufficiently numerous to do serious damage by feeding on the juices of the plant. The danger arises when they pass from an infected to a sound plant, which in the process of feeding they inoculate with the virus. This indicates the necessity of destroying infected plant material so far as possible Unfortunately the virus has an unusual range of herbaceous host plants, which include many popular garden plants as well as common weeds So that in addition to rogueing infected plants in the crop, it is advisable to have the frame yard, where the plants are raised, in rather an isolated position, and to suppress any nearby rough growth which may harbour the disease. A special study of this disease has been made during the season, and a very full report may be expected shortly.

The uneven colouring of tomato fruits may be due to a variety of causes, but one of them is undoubtedly high temperatures. This was very noticeable in certain crops under glass; it is no great cause for wonder as many fruits, even when grown outside, will literally burn if they are not sufficiently shaded from long periods of very hot sunshine. The experience indicates that under such conditions this crop under glass would benefit by the application of a shading wash on the roof of the house in addition to the generous use of an ample ventilating equipment.

Preparation for the coming Season.

It is common knowledge that good crops may be grown readily enough if the land is in good heart, but this will not be its condition after a few years of cropping unless a few matters have received careful consideration and attention in season Drainage, water, shelter, crop rotation, cultivation, and manures are some of these matters

Intensive cropping is most successful on good land with an open subsoil especially when the crops are planted out under glass The forcing culture usually demanded in that case requires an ample supply of water at certain periods, and where natural drainage exists water can be applied with best results In the absence of good drainage the land is cold until late in the season, and its texture and fertility gradually deteriorate: poor late growth is then the result in spite of the high temperatutes obtained later in the season Where land of this class has to be dealt with a thorough drainage scheme should be planned and carried out as circumstances permit. It may be too big an undertaking for immediate execution, but what is possible should be done between seasons until the full scheme is completed. It will consist probably of open drains to carry away the water received from tile drains. Drainage is work which requires careful planning and close supervision to ensure that the tiles are laid truly, at the right depth, and with a suitable fall Work of this kind should be pushed along now giving land under glass the first consideration.

The preparation of the land for next season's cropping compels a decision on the location of each crop, thus bringing up the subject of crop rotation, which must always receive attention if the land is to be kept clean and in good heart In Jersey where for many years early potato crops have been grown for the English market we are told " the average holding is 18 acres of which one-third would be cropped with early potatoes There is no fixed rotation, but in terms of first crops the following is common practice Grass for three years either for grazing alone or mowing and grazing, followed by early potatoes for three or four years A second crop, usually roots, is taken the same year after potatoes . . When the land is sown in grass it is done in place of the root crop, about July or August (January or February here), and is usually well established before winter." Under this arrangement the land is in grass and grazed or mown for from three to six years before it is broken up for cropping. It would then be comparatively clean from serious pests and diseases, well stocked with fibre and humus, and in great heart for cropping. The farm stock would supply the necessary manure, which it is stated is applied at the rate of not less than 25 tons per acre every two or three years. With a generous application of mixed artificial manures before the final cultivation and planting, it is not surprising that good crops are harvested there and the land is maintained in the best condition.

The practice here in many cases is to keep the total area continuously under a system of double cropping annually, which is often a very difficult task if the land is to be kept in good heart for a long period. Under the best conditions—that is, good land and rainfall, and a good supply of farm manure—experienced farmers are obtaining good results with continuous cropping, which cannot be expected under less advantageous conditions in which a system along the lines mentioned above is generally advisable.

Towards the end of April land available for early cropping should have a dressing of organic manures turned under for such crops as require it, while land for late crops, such as tomatoes, may be sown down to oats or barley and horse beans, or other green crop which will make good growth at that season, for ploughing under.

Where new land is to be broken in, hedges should be trimmed well back and the land skim-ploughed to a depth of about 3 in. When the turf has rotted sufficiently, it should be disked, and afterwards, in suitable weather, ploughed deeply and worked to a fine tilth for planting.

The Homestead Garden.

A new lawn should be cut when the grass is 2 in. or 3 in. high and in dry condition. It should be cut as high as the adjustment of the mower permits, as close cutting will be detrimental until a good sole of grass has been established. For this work the mower should be well oiled and carefully set: with most kinds of mowers this is done by an arrangement which permits the cutting edge of the bottom blade being raised or depressed. The right position is that where the revolving cutting cylinder makes an even contact with the bottom blade along its whole length without jambing.

The herbaceous border where it is intended to grow the popular dahlias, chrysanthemums, and other plants grown as annuals may now be planted with spring flowering bulbs and other plants, which can be removed in October and November, in time for planting those mentioned above which make a display in summer and autumn.

The perennial herbaceous border, where the plants remain for three or four years before replanting, should be planted now. Planning this section is a very good test of one's skill and art in arranging colours and foliage. As it is generally one of the prominent features it should receive special care. Good effect is due not so much to the rareness of the plants as to the arrangement and size of the groups. It should be remembered that the quantity, as well as the kind of colour, is important; as colour may easily be so great as to be monotonous or so small as to be insignificant. If the plan is drawn to scale on graph paper it may be transferred to the land by placing a numbered label in the ground each yard along the border front and back: then a garden line or two from end to end dividing the border into strips, each a yard wide. The group outlines as planned may then be drawn on the ground and the drills filled with dry sand. Each space should be marked with a clearly written label, and planting may be done true to plan as occasion permits.

Where the time has arrived for the perennial herbaceous border to be replanted, it is well to lift a group at a time, select suitable pieces for replanting, and place them compactly in a seed box with the name attached so that they may be conveyed to the kitchen garden and planted in nursery rows properly named and remain there until early spring when they will be well rooted. By that time the border should be thoroughly reconditioned by manuring and trenching, and in a settled state suitable for replanting. Where this section is kept well within ones's resources of time and available labour it can afford great pleasure and form a very attractive garden feature.

Herbaceous perennials, bulbous and otherwise, may be planted in the shrubbery and plantations with good effect, but always they should be of a kind that will flourish without the high culture referred to above. Many kinds of daffodils, lilies, scillas, &c., may be planted in established shrubberies, and will be most happy if they are left alone.

—*W. C. Hyde, Horticulturist, Wellington.*

The fifth Science Congress organized by the Royal Society of New Zealand is to be held at Dunedin from 28th May to 31st May next. The work of the Congress will be divided into sections, including an Agriculture section, the secretary of which is Mr C. V. Dayus of the Department of Agriculture, Dunedin.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WORMS IN CALVES.

D. J. B., Onui, Waikato :—

A number of calves have become seriously affected with parasitic worms in the lungs Examination of a slaughtered calf showed the lungs to be infested with the worms. Is there any cure for these worms ?

The Live-stock Division :—

It is always a wise procedure to dose calves with the copper-sulphate solution where you have a parasitic infection, for the stomach worms are the most common and dangerous.

Where you find parasitic infection of the lungs you usually have the stomach worm as well. Small doses of turpentine and milk, a dessertspoonful to a table-spoonful of turpentine, given every second day in about three-quarters of a pint bottle of sweet milk, will assist greatly, but along with this it is necessary to feed the young animals well, a little oats and bran, twice daily, if they will take it, also good hay moistened with a solution of molasses (1–10), and after dosing a change of pasture, when dosing shake the bottle at intervals.

The chloroform treatment simply consists of administering chloroform, but not giving too much The chloroform may be applied on a sponge and the animal's head put in a canvas muzzle, but this should be done only by an experienced person who knows exactly how long to proceed. The nose of the animal should be smeared with vaseline

DIFFICULT CHURNING.

M. K. F., Stanley Brook :—

We are having considerable difficulty in churning our butter. The first time, in January, after the cream became thick, we could get no further change in it. We churned for about two hours, and tried again the next morning, but could not get it to churn to butter.

The Dairy Division :—

The difficulty experienced in churning is one which is not uncommon in warm weather or when the pasture on which the cows are grazing is dry In a year like the present one difficulty is experienced in cooling the cream, and this, combined with the dry feed, is probably the cause of the long churning period. Under farm conditions the control of the temperature depends on the water available, and fairly thick cream should be skimmed, and it should be churned frequently to prevent the development of acid With green feed, cooler temperatures, or a fresh cow in the herd, the trouble usually disappears. It is inadvisable to fill the churn too full.

SEED-CROP OF BLUE LUPINS IN NORTHERN DISTRICTS.

C. A. G., Lyall Bay :—

What may be considered a reasonable possible yield of seed of blue lupins an acre on light volcanic land of good average quality at Kerikeri ?

The Fields Division :—

Blue lupins grow fairly well on the light volcanic land at Kerikeri, and the climatic conditions are suitable for a seed crop. A reasonable yield of seed would be about 30 bushels to the acre. For a good seed-crop the lupins should be planted about the middle of October: with earlier planting too much leaf and stem is developed and the flowering is restricted. On the other hand, according to locality, the lupins should be planted sufficiently early to allow for rapid growth during November and December, when flowering takes place. The seed ripens quickly in January.

UDDER AND SKIN TROUBLE IN COW.

J. M. F., Manurewa :—

A cow (about the fourth calf) calved some eight or nine weeks ago, and her milk seemed sound until about three weeks ago, when the milk from the front two teats suddenly became tinged a deep blood-red colour. The milk from the hindquarters remained normal. She had not been subjected to any known violence. Her health appears normal save that she has been losing her hair in patches from the neck and shoulders. She is a poor yielder, both in quantity and quality.

The Live-stock Division :—

Relative to the cow which appears to be giving blood in the milk from her two front quarters, this condition cannot always be accounted for. It results, sometimes, after calving, from the rupture of small blood vessels, possibly due to physiological changes in the udder. It usually disappears without any treatment whatever. Sometimes, but very seldom, it may be caused by injury.

That she is losing the hair in patches from the neck and shoulders might be caused by ringworm. If you treat ringworm with kerosene, soap, and water, you will clean it up ; dissolve 1 lb. of hard soap in 1 gallon of hot water, and while hot add 1 pint of kerosene and stir well. This makes an emulsion which you may use to wash down the affected parts. Two dressings at intervals of three days should clean up the condition. Any definite round spots you may also paint with tincture of iodine or sulphur ointment.

ASPARAGUS CULTURE.

New Chum, Waitomo Caves :—

The foliage of a bed of asparagus now two years old was cut this year when the berries had turned red Since then the plants have sent up shoots which are now developing foliage. Is this detrimental to the plants ?

The Horticulture Division :—

The foliage on the asparagus is by no means detrimental ; on the contrary the plants should be manured as required with a view to encouraging a strong growth, as that treatment will increase the crop of spears for cutting next spring. The foliage should be cut down in autumn each year when the ripening process is well established.

VINES FOR CANTERBURY.

J. S. W., Horrelville, Rangiora :—

The soil here is flat, and inclined to be wet during a wet winter. The depth of soil averages about 10 in., and there is about 8 ft. of sandy clay beneath the soil. It is rich river-silt land mostly, growing good crops of wheat. Which varieties of vines would be best suited for the soil above described ? Where can, say, half a dozen vines be bought—preferably ones grafted on phylloxera - resistant stocks, as it is considered it would be advisable to start with those in case the disease ever becomes prevalent in this district ?

The Horticulture Division :—

For the conditions described the following varieties of table grape vines are recommended : One Gamay hatif des Vosges, one Madeleine Alice Salomon, two Golden Chasselas (Salomon's selection), and two Portugais bleu. Three other good varieties which should give satisfaction under your soil and climatic conditions are the Madeleine Royale, the Chasselas Rose Royale, and the Sicilien, but we have no grafted vines of these, only rootlings and cuttings. The other vines are grafted on suitable resistant stocks. In this connection the risk of an invasion of phylloxera into your district is very remote. It was found in Auckland City some thirty-five years ago, but up to date has extended northwards only. All the above varieties can be obtained from the Te Kauwhata Horticultural Station in August on the conditions set forth in the price-list forwarded. It would be advisable to plant the vines at least a chain away from the macrocarpa hedge, or, if planted more closely, to cut a deep ditch along the hedge to prevent the roots robbing the vines A covering of scrim when frosts are expected would protect the vines.

WEATHER RECORDS: FEBRUARY, 1935.

Dominion Meteorological Office.

NOTES FOR FEBRUARY.

FEBRUARY saw a continuance of the abnormally warm weather which had been experienced during the preceding three months, but also the break of the drought which had accompanied it in most districts. The beginning of the month was very dry but after the first week humid weather prevailed. Rain became more frequent and widespread and drought conditions were gradually dissipated. Northern districts were the first to be relieved but the rain gradually extended southwards and culminated in the heavy and general rains which fell between the 19th and the 24th. Further rain is still needed in North Canterbury and especially on the Wairau Plains in Marlborough. In most districts the grass is coming away well again and in the North Island there has been luxuriant growth. Stock are in good condition and the milk yield is recovering somewhat. The rain was too late to give a good wheat yield or to save some of the fodder crops. All crops and fruits are maturing early.

Rainfall.—There was a large excess of rainfall over the whole of the North Island, many places having more than double the average fall. In the South Island most of Nelson and Westland, the Alps, and the eastern foothills had more than the average, but elsewhere there was still a deficit. This was large in parts of Marlborough and Southern Otago and Southland.

Temperatures.—Temperatures were much above normal, the departures ranging approximately between 2·5° and 5° F., those on the West Coast being the greatest. There were continuously high temperatures until the 23rd, when a cold spell set in and lasted till the 27th. The four months from November to February have been by far the hottest in the history of the Dominion, and this is true of all parts. Other occasions when the same months were very warm were the 1894–95, 1909–10, 1916–17, and 1923–24 seasons On the present occasion, however, the average excess above normal is almost double the next hottest. Very few places have, however, experienced their hottest individual temperature. Auckland is one of the few that has.

Sunshine.—Sunshine was considerably below normal in most eastern districts but above it in the west. Hokitika had the remarkable record of 270·2 hours. New Plymouth had 247·9 hours and Alexandra 237·2.

Storm Systems.—There was no storm of note during the month. There is no doubt, however, that in the continued hot weather great quantities of moisture had been taken up into the atmosphere and it required only a slight disturbance to cause heavy precipitation. In the early part of the month the unstable conditions were shown by the frequency of thunderstorms and heavy local downpours. These continued until the last week but in the later stages were associated with more general rains.

Some heavy rains occurred in North Auckland at the end of the first week of the month in association with several shallow depressions which were unproductive over most of the remainder of the Dominion.

A second and rather similar series of depressions in the middle of the month caused heavy rains over most of the North Island, especially on the 15th.

The wettest period in the month commenced in a similar way on the 19th and continued till the 24th. On the 22nd the rains were general, and the greater part of the country recorded very heavy falls. Portions of the eastern districts of the South Island, however, again escaped lightly. The heavy rains during this period were associated with a strong invasion of cold air from the south which forced up the warm and damp air over the Dominion, causing it to drop a large part of its moisture.

RAINFALL FOR FEBRUARY, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches		Inches	Inches.	Inches.	Inches.
Kaitaia	8·55	16	2·38	3·50	10·35	7·44
Russell	13·48	13	3·30	2·99	15·28	6·24
Whangarei	8·19	14	1·43	3·87	12·12	7·80
Auckland	9·62	11	4·09	3·12	11·86	5·84
Hamilton	3·93	12	1·98	2·91	5·13	6·48
Rotorua	5·96	16	2·99	3·69	7·80	7·95
Kawhia	6·16	15	3·20	2·86	8·00	6·41
New Plymouth ..	9·47	9	7·29	3·79	14·08	7·98
Riversdale, Inglewood ..	16·08	13	10·90	6·03	24·64	13·54
Whangamomona ..	8·39	6	2·90	3·89	20·10	9·47
Hawera	7·91	12	5·61	2·40	10·15	5·91
Tairua	9·99	10	4·21	4·68	11·38	8·34
Tauranga	3·69	13	0·86	3·51	4·65	7·59
Maraehako Station, Opotiki	5·68	13	2·11	4·14	8·43	7·73
Gisborne	4·89	14	1·90	3·46	6·01	6·18
Taupo	8·98	14	2·48	2·74	10·36	6·11
Napier	5·87	12	1·39	2·78	6·28	5·71
Hastings	4·28	16	1·35	2·25	4·76	4·18
Whakarara Station ..	8·06	14	2·84	..	9·63	..
Taihape	5·50	12	1·67	2·19	8·16	5·39
Masterton	3·68	14	0·90	2·73	4·48	5·33
Patea	8·56	11	3·86	2·40	11·10	5·99
Wanganui .. .	7·31	10	3·48	2·42	9·98	5·25
Foxton	3·39	5	1·48	2·07	5·09	4·21
Wellington	3·40	9	1·11	2·67	5·27	5·48
South Island.						
Westport	6·75	14	2 24	5·35	18·14	13·55
Greymouth	7·30	5	2·77	6·21	21·65	15·38
Hokitika	11·16	9	9·17	7·19	27·65	17·26
Ross	10·43	6	7·56	8·90	25·64	21·30
Arthur's Pass ..	12·84	8	6·90	9·90	33·14	24·02
Okuru, South Westland	5·70	4	3·60	9·66	30·88	22·25
Collingwood	2·46	5	1·53	5·13	8·51	11·71
Nelson	2·96	9	1·05	2·63	6·23	5·44
Spring Creek, Blenheim	0·51	7	0·24	2·18	1·64	4·40
Seddon	0·56	3	0·40	1·85	1·81	3·69
Hanmer Springs ..	3·85	15	0·73	3·20	5·89	7·10
Highfield, Waiau ..	2·82	11	0·90	2·60	3·61	5·58
Gore Bay	2·63	10	0·91	2·80	4·35	5·26
Christchurch	1·04	12	0·31	1·74	1·81	3·92
Timaru	2·30	10	0·78	1·84	4·61	4·11
Lambrook Station, Fairlie	1·91	5	1·24	1·81	4·58	4·24
Benmore Station, Clearburn	3·65	10	1·47	1·62	5·53	4·39
Oamaru	1·75	12	1·04	1·79	3·28	3·83
Queenstown	1·92	6	0·57	1·94	6·27	4·86
Clyde	1·67	7	0·76	1·06	3·61	2·91
Dunedin	2·40	11	0·74	2·73	5·44	6·16
Wendon	1·65	7	0·65	2·26	5·88	5·46
Balclutha	1·64	7	0·58	1·99	5·68	4·30
Invercargill	1·53	10	0·43	3·12	8·72	7·13
Puysegur Point ..	1·65	8	0·66	5·74	16·54	13·36
Half-moon Bay ..	1·08	8	0·31	4·08	9·17	8·90

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AGRICULTURAL LEGISLATION OF 1934.

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LEGISLATION passed during the 1934 session of Parliament and directly or indirectly affecting the primary industries of the Dominion and those engaged in agricultural or pastoral pursuits is contained in the following Acts—viz., the Agriculture (Emergency Powers) Act, the Noxious Weeds Amendment Act, the Slaughtering and Inspection Amendment Act, and the Stock-remedies Act. In the following notes the provisions of the several Acts are reviewed. The notes are not intended to be exhaustive, and persons interested in any particular statute are advised to obtain a copy of the Act, which may be had on application to the Government Printer, Wellington, on payment of a small sum varying with the relative Act but not exceeding 9d. per copy.

AGRICULTURE (EMERGENCY POWERS) ACT, 1934

The object of this statute is to provide for the establishment of an Executive Commission of Agriculture; to reconstitute the New Zealand Dairy-produce Control Board and extend its powers; and generally to enable effect to be given to the recommendations of the Royal Commission appointed last year to inquire into matters affecting the dairy industry of the Dominion. The Act is divided into four parts—viz., Part I, The Executive Commission of Agriculture; Part II, the New Zealand Dairy Board; Part III, financial provisions; and Part IV, enabling provisions.

PART I.

Under this Part a body called the Executive Commission of Agriculture is established, consisting of the Minister of Agriculture and three other members, the latter to be appointed by the Governor-General in Council for a period of five years. The Minister of Agriculture shall be the Chairman of the Commission, and a Deputy Chairman shall be appointed from among the other members, two of whom shall be persons who, at the date of their appointment, are or have been either actively engaged as producers in some branch of primary production, or actively engaged in the manufacture or marketing of primary products, or in some commercial or other undertaking closely associated with the production, manufacture, export, or marketing of primary products. No member of the Commission

except the Minister of Agriculture shall be engaged in any paid employment otherwise than as a member of the Commission. The personnel of the Commission, the appointment of the members of which was announced last month, is as follows: Hon. C. E. Macmillan, Minister of Agriculture, Chairman; His Honour Mr. Justice Frazer, Deputy-Chairman; George Duncan, Esq.; and David Jones, Esq.

The functions of the Commission are—(*a*) To co-ordinate the work of the several Boards and other authorities exercising powers with respect to any of the primary products of the Dominion; (*b*) to exercise any powers that may be transferred to it under section 7; (*c*) to make such recommendations to the Government as it thinks proper with a view to the making of regulations under Part IV; and (*d*) such other functions as may be lawfully conferred upon it by regulations under Part IV.

Under section 7 of the Act any powers now vested in the various Control Boards with respect to certain primary products—viz., meat, dairy-produce, fruit, honey, poultry, and eggs may by Order in Council be transferred to the Commission. No powers shall be so transferred, however, except after consultation between the Commission and the Board in which the powers are vested. On the transfer of any powers the Board in which the powers were vested may continue to exercise such powers with the authority of the Commission and subject to such conditions as the Commission may approve, but not otherwise. The expenses of the Commission shall be defrayed out of the funds of the Board or Boards whose powers and functions have been assumed by the Commission in such proportions as may be agreed upon, and, in cases of dispute, as determined by the Governor-General in Council. In any other case the expenses of the Commission may be paid out of moneys appropriated by Parliament.

PART II.

By Part II important amendments are made to the Dairy-produce Export Control Act, 1923. The Act should now be cited as the Dairy-produce Act, 1923, and the name of the Board established thereunder has been changed to the New Zealand Dairy Board. The term "dairy-produce," which by the principal Act means "butter and cheese," has been extended to include all other products of milk or cream whether produced by manufacturing processes or otherwise.

Provision is made for the reconstitution of the Board by providing for a reduction in the present membership from twelve to seven members, of whom three members shall be appointed by the Governor-General in Council, one by the New Zealand Co-operative Dairy Co., Ltd., and three members shall be elected by dairy companies, one for each of three wards into which the Dominion is divided for that purpose—viz., the Northern Ward, comprising approximately the northern half of the North Island; the Middle Ward, being the balance of the North Island, and the Southern Ward, being the South Island, Stewart Island, and the Chatham Islands. On a date to be fixed by the Governor-General in Council the present members of the Board shall go out of office and be succeeded by the members of the reconstituted Board.

Elections of the elective members shall be conducted by post, the voting by companies being expressed in terms of tonnage votes on

the basis of one vote for each ton of butter manufactured or its equivalent. Two tons of cheese or 2,000 lb. of butterfat comprised in any other manufactured product shall be the equivalent of 1 ton of butter. Detailed procedure in the conduct of the first elections of the elective members is contained in the Dairy Board Election Regulations, 1935, made under Part IV of the Act.

The Board may, in addition to its existing powers in relation to butter and cheese intended for export, but in accordance with regulations to be prescribed, regulate and control the production of dairy-produce in New Zealand and the handling, marketing, transport, and distribution of dairy-produce intended for local consumption. The Board may appoint committees to whom it may delegate its powers except the power to fix the amount of any levy which the Board may impose on dairy-produce. A person not being a member of the Board may be appointed to any such committee. The Board is empowered to fix, within the maximum levies prescribed by regulations under Part IV, the amount of any levy payable on dairy-produce manufactured for sale, whether subject to the control of the Board or not. Differential levies may be prescribed in respect of different kinds of dairy-produce, and in respect of dairy-produce exported and dairy-produce intended for local consumption.

PART III.

Part III of the Act authorizes the expenditure out of the Public Works Fund on such terms and conditions as may be prescribed by the Minister of Finance of moneys appropriated by Parliament for the rehabilitation of the dairy industry, and in particular for any of the following purposes: (*a*) The construction, reconstruction, equipment, and improvement of dairy factories; (*b*) securing improved conditions in and about dairies; (*c*) the eradication of disease in dairy herds. For the current financial year there may be paid out of the said Fund for the purposes aforesaid an amount, to be approved by the Minister of Finance, not exceeding £500,000

PART IV.

This Part of the Act confers power to make all such regulations as may be considered necessary for the purpose of giving effect to the recommendations of the Dairy Industry Commission, and generally for securing the effective conduct of any of the industries over which the Executive Commission of Agriculture has any statutory or other functions. Any regulation made under this Part of the Act shall not be invalid because it deals with a matter dealt with in any Act or because of repugnancy to any Act. No person shall be liable in damages for breach of contract if such breach is occasioned by compliance with any regulations made under Part IV. All regulations must be laid before Parliament, and shall expire on the close of the last day of the session in which they are so laid unless they are expressly validated or confirmed by an Act passed during that session. While any regulation continues in force, it shall have the force of law as if it were enacted in the Act.

Noxious Weeds Amendment Act, 1934.

The object of the Act is to impose additional obligations and liabilities on occupiers of land with regard to the clearing of noxious weeds and to confer additional powers to ensure enforcement of the law in this matter. Accordingly, the amending Act imposes a continuous obligation on the occupier of land on which ragwort is growing, in districts where the plant is a noxious weed, to clear the weed from his land and to keep the land so cleared. Where, on the default of an occupier to clear his land of any noxious weed, the work of clearing is undertaken by an Inspector in the exercise of his powers under the principal Act, the cost so incurred may, on judgment for the amount being obtained against the occupier, be charged against the land, and the amount of the judgment may be enforced in the same manner as a judgment for rates may be enforced. Where the mortgagee pays any money for expenses incurred by an Inspector in clearing land under mortgage to him, the amount paid shall either be deemed to form part of the principal sum secured by the mortgage or, at the mortgagee's option, the amount so paid shall be recoverable from the mortgagor.

For the purpose of extending the principle of local control in the matter of the administration of the Noxious Weeds Act, a principle which was laid down in 1927 when Borough Councils and Town Boards were vested with power to administer the Act in their respective districts, provision is contained in section 7 of the amending Act whereby any County Council may now assume administration of the Act within the county, the procedure being by resolution of the Council, a copy of which must be forwarded to the Minister of Agriculture for gazetting. Upon the passing of the necessary resolution Inspectors under the Act may be appointed by the Council having all the powers within its district of the departmental Inspectors except the power to enforce sections 9 and 10 of the principal Act (relating to the sale of noxious seeds, undressed seeds or grain, and the cleaning of threshing-machines).

Appeals against the requirements of a Council's Inspector set out in notices served on occupiers of land for the purpose of enforcing the provisions of the Act are to be made to the Council. The powers of departmental Inspectors within any county that has assumed administration of the Act shall not be abridged or affected, but no such Inspector shall exercise any powers within the county except by direction of the Minister of Agriculture and after written notice has been given to the Council. The powers conferred by the principal Act with respect to the clearing of unoccupied Crown and Native lands shall be exercisable by the Council or its Inspectors only in such cases and upon such terms and conditions as are determined by the Minister. By section 13 of the Finance Act (No. 2), 1927, all fines recovered on informations laid by the Council's Inspector may, on application to the Minister of Finance, be paid into the general fund or account of the county subject to 5 per cent. of the amount of such fines being deducted and credited to the Ordinary Revenue Account of the Consolidated Fund.

The amending Act also authorizes any County Council which has assumed administration of the Act to levy rates for clearing noxious

weeds within the county. Rates may be levied either on the rateable-value basis or on the acreage basis in respect of all rateable property in the county. Differential rates may be levied, and for that purpose the Council may divide the county into subdivisions and must classify the lands in the several subdivisions, or in the whole county, as the case may be, into Class A, Class B, and Class C lands. Class A lands are lands for the immediate and direct benefit of which the proceeds of the rate are to be expended; Class B lands are lands for the less direct benefit of which the proceeds of the rate are to be expended; while Class C lands include all other lands. The rate is leviable only on Class A and Class B lands in such proportions as the Council may appoint. Public notice of the proportions proposed to be appointed must be given and a meeting of the Council held not less than twenty-eight days thereafter to consider all objections received. Similar notice must also be given of every classification of the lands within the county, and any person aggrieved thereby may appeal to a Magistrate against the classification on the ground that the land of the appellant or any other land has not been classified or has not been fairly classified. On the hearing of an appeal the Magistrate may cause the classification-list to be amended in such manner as he thinks reasonable, and the determination of the Magistrate shall be final and conclusive. Any classification-list may be amended by the Council but every amendment must be authenticated in the manner prescribed for a classification-list and is similarly appellable.

Other amendments of a machinery nature modify in certain respects the legal procedure to be followed in enforcing the provisions of the law in this matter.

Slaughtering and Inspection Amendment Act, 1934.

The object of this statute is to make better provision for regulating the slaughter of stock intended for export in the interests of the meat-export industry generally. By section 2 the Minister of Agriculture, acting on the recommendation of the New Zealand Meat-producers Board, may, by notice served on the licensee, fix at any time during the currency of a meat-export slaughterhouse license the maximum number of stock or the maximum number of any specified kind or class of stock that may be slaughtered in the meat-export slaughterhouse during any period specified in any such notice. Where any stock is slaughtered contrary to the terms of any notice the licensee of the meat-export slaughterhouse shall be liable to a fine of £400 for every day on which stock is slaughtered in any period after the maximum number fixed for that period has been slaughtered.

By section 3 all additions to or structural alterations of any meat-export slaughterhouse (including all cooling, freezing, and storage chambers used in connection therewith) and any increase of its freezing power must be made only with the prior approval of the Minister given on the recommendation of the Board. For the purpose of determining whether any application for approval of any proposed work should be granted the Minister and the Board are required to take into consideration—(*a*) Whether there is any economic necessity or justification for the proposed work; (*b*) the probable or possible effect of the proposed work, if authorized, on the ability of other owners of meat-export slaughterhouses to obtain regular supplies of stock sufficient

for the reasonable requirements of their business; and (*c*) all other relevant matters as the Minister or the Board thinks proper. The penalty for proceeding with any proposed work without having obtained the Minister's approval thereto is a fine not exceeding £500.

The prior approval of the Minister is also required to the erection of new premises for use as a meat-export slaughterhouse. Plans and specifications of the proposed new premises must be furnished to the Minister. After taking into consideration the same matters as are applicable to the disposal of an application for authority to make structural alterations of an existing meat-export slaughterhouse, the Minister may undertake to give his consent to the grant of a license in respect of the proposed premises if completed and a license applied therefor within twelve months from the date of his undertaking or such extended time as the Minister may allow.

By section 5 the licensee of every meat-export slaughterhouse, while the slaughterhouse is open for the slaughter of stock for export, must receive for slaughter all stock intended for export offered by a producer who has raised or fattened such stock. The stock must be slaughtered and the meat therefrom exported, if the producer so requires on his behalf in accordance with such conditions and in consideration of the payment by the producer of such charges and allowances and the fulfilment by him of such conditions as may from time to time be approved by the Minister on the recommendation of the Meat-producers Board. The like provision may be applied by the Minister on the recommendation of the Board, made after full inquiry and discussion with the parties concerned, to require the licensee of a meat-export slaughterhouse to receive, slaughter, and handle stock intended for export on behalf of owners not being producers of stock for export. Notice of the approval by the Minister of such charges, allowances, and conditions, and of their application to owners, not being producers of stock for export, shall be given in writing to the licensee.

The amending Act further provides that the Minister may, without in any way restricting the discretionary powers conferred on him by statute, refuse his consent to the grant, renewal, or transfer of a meat-export slaughterhouse license if the licensee is convicted of an offence under the Act or fails to comply with any of the conditions approved by the Minister with regard to the receiving, slaughtering, and handling of stock for export on behalf of producers and other owners. Under the 1918 amending Act the Minister may refuse his consent to the grant, renewal, or transfer of a meat-export slaughterhouse license if he is of opinion, on such grounds as in his discretion he deems sufficient, that the business of the meat-export slaughterhouse has been carried on, or is about to be carried on, in a manner contrary to the public interest. In this connection the 1934 statute contains a declaratory provision to the effect that the buying of stock to be slaughtered for export shall be deemed to be part of the business carried on under a meat-exporter's license or of the business of a meat-export slaughterhouse for the purposes of sections 4 and 7 of the 1918 Act, and that the buying of such stock in a manner contrary to the public interest shall accordingly be deemed to be a ground for the revocation of a meat-exporter's license or for the Minister's refusal to consent to the grant, renewal, or transfer of a meat-export slaughterhouse license, as the case may be.

STOCK REMEDIES ACT, 1934.

The purpose of this statute, which comes into force on 1st June next, is to make better provision for controlling the sale of stock-remedies. For the purposes of the Act the term "stock-remedy" means any substance (including vaccines, sera, and other biological products) manufactured, advertised, or sold as a remedy for general use for the cure or prevention of disease in stock, or for the destruction or prevention of parasites of stock, or for the maintenance or improvement of the health or condition of stock, but does not include any substance which is used primarily as a stock food.

The Act provides for the establishment of a Board called the Stock Remedies Registration Board consisting of three persons to be appointed by the Governor-General as follows: (*a*) The Registrar, from among the veterinary surgeons in the service of the Department of Agriculture; (*b*) one person on the recommendation of the New Zealand Veterinary Association; and (*c*) one person on the recommendation of the Pharmacy Board of New Zealand.

Before any stock-remedy is sold it must be registered in accordance with the provisions of the Act and of regulations thereunder. Registration enures for a period of three years, and a stock-remedy may from time to time be re-registered for a similar period. Application for registration must be made by the proprietor, which term means, in the case of a stock-remedy manufactured in New Zealand, the manufacturer thereof, and, in the case of a stock-remedy manufactured overseas, the importer thereof. The application must set out the name of the stock-remedy, the trade-mark (if any) to be used in connection therewith, a description of its composition, and the preventive or remedial properties claimed in respect of the remedy. Specimen copies of every label or advertisement to be used in respect of the stock-remedy must support the application, which must be verified by the statutory declaration of the applicant. In setting out the composition of a stock-remedy the name of each ingredient, the form in which it occurs, and the proportion present in the remedy must be stated. The proportion of any ingredient present must be stated as a percentage by weight in the case of a solid stock-remedy, and as a number of grams per 100 c.c. in the case of a liquid stock-remedy. A semi-fluid remedy shall be deemed to be liquid unless recommended for use by weight. An applicant for registration may be required by the Board to furnish certificates of analysis and experimental or other evidence in support of his claims as to the efficacy of his stock-remedy. Registration may be refused if the Board is of opinion that any statement in an application for registration, or in any label or advertisement, is inaccurate, inadequate, or misleading, and cannot be conveniently omitted, altered, or amplified so as to comply with the Act. The Board may also refuse to register a stock-remedy which contains incompatible or volatile ingredients or which in its opinion is likely to be injurious to stock. The necessary regulations relating to registration and applications for registration of stock-remedies are now in the course of preparation.

To ensure that every stock-remedy sold is registered and that every registered stock-remedy is sold in compliance with the Act, the statute makes it an offence for any person—(*a*) To sell a stock-remedy before he has received a certificate of registration, in

the case of the proprietor, or a notification that the stock-remedy has been registered, in the case of any other vendor; (*b*) to sell a registered stock-remedy after the period of registration or notification received by him has expired; (*c*) to sell a registered stock-remedy in a receptacle which does not bear an approved label showing, with such other matter as the Board may approve, the name and address of the proprietor; the name of the stock-remedy; and the trade-marks, if any, under which it is sold; the net weight or volume of the product contained in the receptacle; the preventive or remedial properties claimed in respect of the remedy and directions for its use; (*d*) to sell any stock-remedy in a receptacle bearing a label containing any false or misleading particulars in relation to the contents of the receptacle; (*e*) for the proprietor or the vendor of a registered stock-remedy to use or publish any label or advertisement relating to the stock-remedy which has not been approved by the Board or which differs materially from an approved label or advertisement.

On the sale of any stock-remedy there is an implied warranty by the proprietor that the stock-remedy is reasonably fit for any purpose expressly or impliedly suggested in any label or advertisement used or published in respect of the stock-remedy. No such warranty by the Board or by the Government is to be implied by reason of registration or approval of labels or advertisements in respect of any stock-remedy.

Inspectors appointed under the Act are empowered to take samples of any stock-remedy for analysis, either on their own initiative or at the request of the buyer. In respect of any sample analysed pursuant to the Act the Analyst is required to compare the result of his analysis with the particulars in the application for registration of the stock-remedy from which the sample was taken, and where a discrepancy is found between the result of his analysis and those particulars, the Analyst must add to his certificate a statement as to whether the discrepancy would, in his opinion, be materially to the prejudice of a purchaser. Where a sample is proposed to be taken for analysis at the request of the buyer, the Inspector must satisfy himself that the receptacles containing the stock-remedy are in a sound condition, that they have been properly stored, and have not been opened or tampered with in any way. The vendor and the proprietor or their agents may be present at the taking of the sample, and, if the result of the subsequent analysis shows that the stock-remedy is not materially at variance with the particulars in the application for registration of the stock-remedy from which the sample was taken, the vendor and the proprietor shall be entitled to any reasonable expenses to which they may have been put in attending at the place at which the sample was taken.

The Board is empowered to publish in such manner as it thinks fit and without liability the results of any experiments made with any stock-remedy, or, with the approval of the Minister of Agriculture, to publish the results of any analysis of any stock-remedy or any particulars relating thereto, if in its opinion publication is desirable in the public interest or for the protection of purchasers.

Nothing in the Act limits the operation of the Poisons Act, 1908, the Dangerous Drugs Act, 1927, the Patents Act, 1908, the Patents, Designs, and Trade-marks Act, 1921–22, or any regulations thereunder.

GENERAL.

In addition to the foregoing, reference is made to two provisions of the Finance (No. 3) Act, 1934. Section 28 of the Act provides for the payment to local authorities of a subsidy from the Main Highways Revenue Fund equal to 12½ per cent. of the rates levied for the year ending 31st March, 1935, on lands used exclusively or principally for agricultural, horticultural, or pastoral purposes, such subsidy to be applied in relief of ratepayers by way of refund or rebate of a like percentage of the rates levied on such lands for the current financial year.

By section 32 of the Act the New Zealand Poultry Board is authorized to pay an additional amount not exceeding £471 in reimbursement of expenses incurred by the New Zealand Poultry Association in organizing the poultry industry before or after the commencement of the Poultry-runs Registration Act, 1933.

GARDEN LAWNS AND PLAYING-GREENS.

ESTABLISHMENT AND MAINTENANCE.

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THE New Zealand Green-keeping Research Committee(1) has been operating now for three years, and during this time much information has been secured from the experimental plots at Palmerston North, and from careful observations on garden lawns, bowling-greens, and golf-courses. In response to the many requests for advice regarding the laying-down and maintenance of lawns, this article has been prepared with a view to making current information available in a popular way.

The subject is dealt with under the following headings: (*a*) Preparation of the ground, (*b*) time to sow, (*c*) seed-mixtures, rates of seeding, and methods of sowing, (*d*) mowing and rolling, (*e*) lawn maintenance and manuring, (*f*) lawn weeds, (*g*) weed control, (*h*) grass-grub control, (*i*) subterranean grass caterpillar, and (*j*) earthworm control.

PREPARATION OF THE GROUND.

Some months prior to the sowing-down of a lawn attention should be given to the preparation of a deep yet well-consolidated seed-bed. With this end in view it is recommended that the ground should be turned over in late spring, roughly levelled, and allowed to lie fallow. The common practice of growing a crop of potatoes on an area to be sown in lawn is not recommended, as this rarely allows sufficient time for deep consolidation of the soil between the time of lifting the potatoes and the time for seeding. Deep consolidation is really only secured as a result of a natural settling, and time is an essential factor in this. Summer fallowing, where the surface, to a depth of from 2 in. to 3 in.,

(1) Figures in parentheses refer to citations given at end of this article.

is being cultivated constantly, is the best means to secure the correct consolidation in the seed-bed. The surface cultivation over this period is also effective in ridding the surface soil of weeds. The latter cultivations after levelling has been effected should be reduced in depth to ½ in. to 1 in., to allow a natural settling-down of the top 2 in. to 3 in. Each shallow cultivation will leave sufficient loose surface soil to permit this to be raked from the mounds into the hollows with a levelling-board. This implement can be made by attaching a suitable handle to a board, which should be about 4 ft. in length. The handle is attached in a manner similar to that in which a rake or hoe handle is fixed to the tool itself. The levelling-board can be dragged over the area much in the same way as a rake would be used. After each grading the soil should be firmed by rolling, following which the surface soil should again be loosened by a light raking. In most parts of New Zealand the final preparation of the ground should be completed by about the third week in March, and its accomplishment requires that a fairly fine tilth to a depth of about ½ in. should overlie a firm and well-consolidated bed—*i.e.*, one free from undulations after the final rolling.

Time to Sow.

The season for the establishment of lawns depends largely on climatic conditions. In the North Island or elsewhere, where summer droughts are experienced, sowings should be made in the autumn just so soon as one may expect the cessation of the dry weather.

Speaking generally of the North Island, this occurs in the third week in March, and experience has shown that this period is ideal for seeding. In the drier parts of the South Island where heavy frosts are experienced, sowings should be made from three to four weeks earlier than this if at all possible. In Southland, or other southern districts having a well distributed summer rainfall, sowings are best made in the late spring; but it must be stressed that on no account should spring sowings be made where the drying-out of the soil in the summer is the rule. Even artificial watering of such greens is seldom satisfactory.

It must be remembered that for the first few months after establishment the root systems of grass plants are not well developed, and the plants are unable to draw their moisture requirements from any considerable depth. Consolidation of the soil, which was mentioned previously, is rarely completed until the lawn has had the winter rains upon it, so it will be readily understood that, with a weak open turf and a loose surface soil, the moisture is quickly evaporated in the summer with a consequent weakening of the seedling plants. It is on account of the above facts that autumn sowing is generally the more satisfactory. Too late autumn sowings should be studiously avoided, as the fine lawn grasses, particularly brown-top, cannot tolerate wet cold conditions whilst in the seedling stage, and if during this period a set-back is given the establishing plants, soil fungi may be particularly harmful and considerably reduce the stand.

FIG. 1. TWO PLOTS SOWN AT THE SAME TIME

One on left received no fertilizer, one on right manured at time of seeding with quickly acting fertilizer Note that seed-bed was not rolled after seed was raked in.

[Photo by E. Bruce Levy.

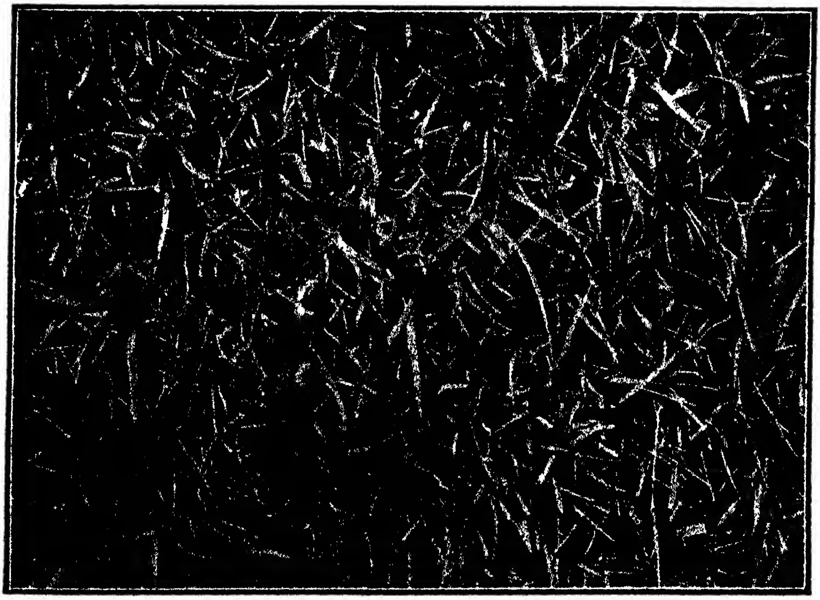

FIG. 2. WEAK OPEN TURF DUE TO INSUFFICIENT FERTILIZER.

Bare patches are open to weed invasion.

[Photo by E. Bruce Levy.

SEED-MIXTURES, RATES OF SEEDING, AND METHODS OF SOWING.

Up to the present no more satisfactory lawn grass seed-mixture can be recommended than that of Government certified brown-top 1 part and New Zealand Chewings fescue 2 parts, sown at the rate of 1 oz. of mixture per square yard.

This seed-mixture under average New Zealand conditions produces a dense fine turf which should be able to withstand a variety of climatic conditions. Brown-top thrives best under moist conditions on a moderately fertile soil, while Chewings fescue is better able to withstand moderately dry conditions and a somewhat poorer soil. Both these grasses are fine-leaved, dense turf-formers, and very easy to mow.

In the research work at Palmerston North Chewings fescue and brown-top were sown pure and in varying combinations. Species additional to brown-top and Chewings fescue were also included in the trials, but after three years, as far as the present greens are concerned, no advantage resulted from the inclusion of these extra species, except perhaps in the early days of establishment. Both rye-grass and crested dogstail assisted in the rapid formation of turf, but ultimately to the detriment of the finer turf grasses.

The results of these sowings are indicated in Table 1.

Table 1.—Showing relative Value between Pure Sowings of Brown-top and Chewings Fescue and Mixtures of these, also Mixtures containing Species other than Brown-top and Chewings Fescue

(Analyses (2) made on Green-keeping Research plots when less than one year old.)

—	Brown-top—Pure (1)	Chewings Fescue—Pure (2)	Brown-top and Chewings Fescue, 1 : 2 (3)	Brown-top, Chewings Fescue, and Crested Dogstail, 1 : 2 : 2. (4)	Brown-top, Chewings Fescue, and Rye-grass, 1 : 2 : 2. (5)
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Bare ground ..	13·0	12·0	6·0	11·0	19·0
Brown-top	56·6	1·8*	32·6	14·7	3·3
Chewings fescue ..	..	62·6	51·8	39·7	18·2
Crested dogstail ..	..	..	..	25·7†	..
Perennial rye-grass ..	..	..	..	..	53·7‡
Weeds	30·4	23·6	9·6	8·9	5·8
	100·0	100·0	100·0	100·0	100·0

* Volunteer (not sown).
† Died out under close mowing in less than two years.
‡ Tough fibrous leaves—hard to mow. Rye-grass practically died out in two years due to close mowing; turf is now very thin, and open to weed-invasion.
NOTE.—The figures in column 3 show less bare ground and a higher percentage ground-cover by fine lawn grasses—namely, brown-top and Chewings fescue.

To ensure a good type of brown-top being secured the purchaser should specify Government certified seed of high purity and germination. Chewings fescue is not included amongst the seeds certified by the Government, but purity and germination certificates should be examined by the purchaser, as seed of poor germination, or that which contains much weed seed impurity, cannot be expected to produce a satisfactory lawn.

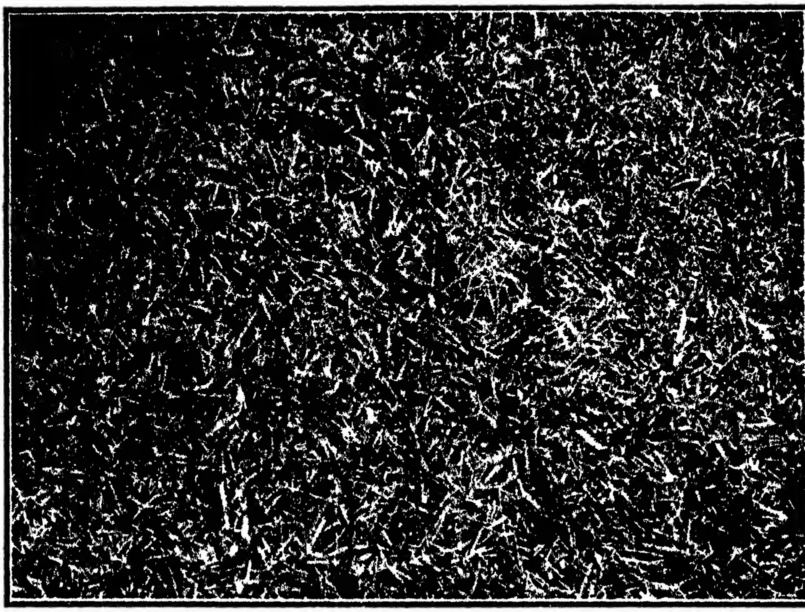

FIG. 3. DENSE BROWN-TOP-CHEWINGS FESCUE TURF CORRECTLY MANURED.
[Photo by E. A. Madden.

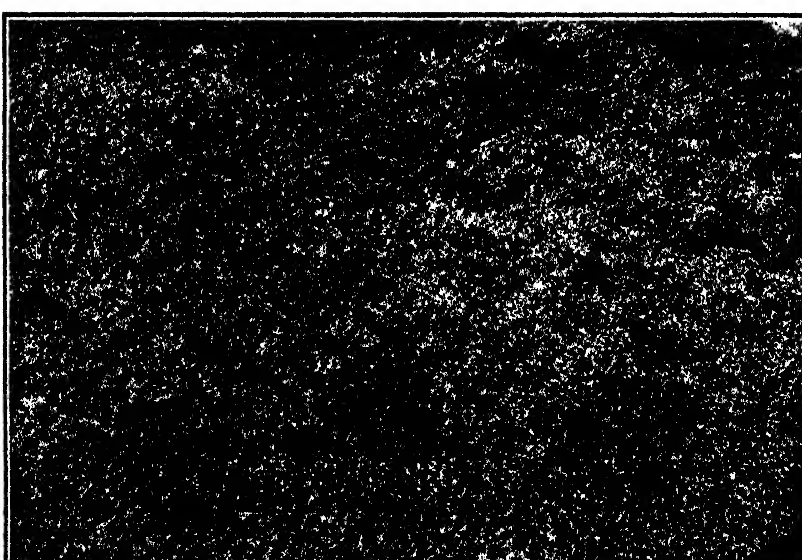

FIG. 4. WEED ERADICATION WITH ARSENIC PENTOXIDE SPRAY.
Left: Weeds killed by spray. Right: Strong weed growth.
[Photo by H. Drake.

In the case of sowing down larger areas for sports such as football and hockey, special seed-mixtures containing the species that can stand harder wear should be used. For such sowings the following seed-mixture (in pounds to the acre) is recommended: Brown-top, 10; Chewings fescue, 20; certified perennial rye-grass, 60; crested dogs-tail, 10.

The even distribution of the seed is important, and to accomplish this it is advisable to check sow—that is, half the seed is broadcast over the whole area in one direction and the remainder is sown across at right angles to the first. Immediately after the seed has been sown a dressing of fertilizer should be applied so that it may be incorporated with the soil and be readily available to stimulate the young plants. This initial manuring, irrespective of soil types, is important to ensure quick establishment and vigorous grass growth and so reduce the competition of the weeds which also may have established (fig. 1). Quickly-acting fertilizers are essential, and a mixture of superphosphate and sulphate of ammonia in equal parts at the rate of 1 oz. per square yard is recommended.

Table 2.—Showing the Percentage of Ground not covered and that which is covered by various Species, and illustrating the beneficial Effect of applying the correct Manures at the Time of Seeding-down.

(Analyses (2) of turf made on Green-keeping Research plots approximately six months after laying down.)

—	Quickly acting Nitrogenous-phosphatic Fertilizers as recommended above	Slowly acting Nitrogenous-phosphatic Fertilizer.	No Fertilizer.
	Per Cent.	Per Cent.	Per Cent.
Bare ground	8·0	17·0	32·0
Brown-top	52·4	41·0	22·4
Chewings fescue	37·1	30·6	32·4
Weeds and clover	2·5	11·4	13·2
	100·0	100·0	100·0

The use of lime irrespective of soil type and conditions is not recommended. (See subsequent paragraph regarding manuring.)

As soon as the seeds and fertilizers have been sown the surface soil should be raked lightly to cover the seed. Deep raking for these fine seeds is unnecessary, and it usually results in having some seeds buried at too great a depth for them to germinate.

The maintaining of an even and level surface when raking the seed in is important.

Rolling after raking the seed in is not recommended, as this compacts the surface soil and makes it more difficult for seedling plants to push their way up. This is particularly true if rain falls and tends to cake the surface prior to the young plants appearing above ground. Further, if the surface soil is not smoothed by rolling some protection from wind is afforded the tiny plants, and there is less chance of the surface soil and seed being swept away by strong wind.

Mowing and Rolling of the Young Lawn.

When the grasses are well established and about 1 in. to 1½ in. in height, the young lawn may be rolled with a light roller only. Heavy rolling of young establishing greens at Palmerston North resulted in temporary damage to the young grass. The light rolling should firm the surface somewhat and flatten any small lumps of soil.

A few days after the first rolling the grass can be mown, but a point of great importance is to see that the mower blade is lifted sufficiently high to prevent cutting the young plants too closely. The turf density, which is so desirable, will be obtained more quickly from vigorous growing and strong-tillering plants, and to maintain a vigorous growth it is imperative that, particularly while young, grass must not be mown too severely or too continuously. For subsequent mowings the mower blade may be lowered still farther each time until ultimately the turf is being cut to the required closeness.

There is much controversy as to whether or not the clippings should be left on the lawn. They certainly rot down and provide plant food and they have a mulching effect on the soil in an open turf, thus preventing loss of moisture by evaporation; but against these facts one must point out that the requisite amount of plant-food is cheaply and easily applied with artificial fertilizers, and also that the smother created by mulching with clippings will ultimately cause an opening of the turf. A dense turf itself will prevent the loss of moisture by evaporation.

Should weeds such as *Poa annua*, suckling clover, and Onehunga weed be present in the turf, and they frequently are, then by removing the clippings mature weed-seeds are not permitted to fall on the turf and re-establish. This is an important factor in controlling weeds in the lawn.

Continual close mowing deprives the grass plants of their leaves, organs which are equally as essential to vigorous growth as are roots. Unless grass plants have sufficient leaf to permit carbon-fixation the plants weaken. Weak plants are unable to make strong growth, and so the turf slowly opens up. It is recommended that the lawn be spelled from close mowing occasionally, but in so doing the grass must not be allowed to grow to more than say 2 in. in height, or tillering will be inhibited and the turf will then open from this cause After spelling the lawn, the grass should not be cut close suddenly; it is better to lower the mower blade a little each week until the turf is reduced to the required height. Spelling from close mowing will usually be more beneficial during the summer period, when the extra grass growth will protect the soil from the sun's rays and thus prevent moisture losses by evaporation.

Lawn Maintenance and Manuring.

Although the establishment period is perhaps the most critical in obtaining a good turf, the subsequent treatments govern what the ultimate turf will be.

Strong, healthy, vigorous grasses in a dense turf can usually compete more than favourably with common lawn weeds. It is neglect of the requirements of the grasses that usually results in the deterioration of the lawn, with a consequent opening of the turf and the establishment of weeds (figs. 2 and 3).

When one considers the amount of plant-food which is annually removed in the grass clippings it is realized readily that unless some effort is made to maintain the soil fertility the grasses must slowly weaken through partial starvation.

It has been found that the required standard of soil fertility can be maintained by the following treatments. During the months of April and September a mixture of superphosphate 3 parts, sulphate of ammonia 4 parts, and finely ground sulphate of iron 1 part, should be applied evenly at the rate of 1½ oz. per square yard, or approximately 4 cwt. per acre. In January and again in June a mixture of superphosphate 3 parts and nitrate of soda 4 parts should be applied at the rate of 1 oz. per square yard, which is equal to about 300 lb. per acre. The mixture recommended for the April and September dressings, by virtue of the quantity of sulphate of ammonia and sulphate of iron present, should check weed and clover growth and at the same time supply a readily available plant-food to the grasses. The January and June top-dressings are not intended to do any more than maintain a standard of fertility which should favour the growth and tillering propensities of the grasses.

The continual use of sulphate of ammonia and sulphate of iron has a marked tendency to increase soil acidity while nitrate of soda acts in the reverse manner. A degree of soil acidity is considered to be most desirable, but if acidity is permitted to increase too much harm to the turf grasses must follow. With the object of maintaining the desirable degree of soil acidity the above-mentioned manurial programme should be followed with exceptions in certain cases, which will be dealt with in subsequent paragraphs.

Superphosphate is frequently viewed with suspicion as a lawn fertilizer by many greenkeepers and gardeners on account of its tendency to induce clover and favour its growth; but it must be remembered that grasses also require phosphate if they are to thrive. Vigorous grasses are better able to compete with clover than are weak grasses, and as the clover should be controlled not at the expense of the grasses then the use of superphosphate cannot be condemned. Clover control is dealt with in the "Weed Control" section of this article.

Lime is not recommended for lawn top-dressing except under extreme circumstances, and then only after the condition of the turf grasses and that of the soil has been carefully studied. Contrary to common belief, lime will not kill moss in lawns—in fact, it is more likely to favour moss growth, especially under close-mowing conditions. As an instance of this, the reader's attention may be drawn to the moss-covered mortar (which contains a high percentage of lime) which is so frequently seen on the moist and shady side of old brick buildings.

After trials at the Green-keeping Research Area at Palmerston North with most of the quickly acting and slowly acting fertilizers procurable it has been found that the quickly acting ones have given definitely superior results for lawns and playing-greens, not only by promoting the growth of a dense healthy turf but also by inhibiting weed growth.

Both compost and sand may be used to advantage for levelling purposes, but according to the nature of the soil so should either compost or sand be used, and as a guide in this matter it should be pointed out that heavy applications of compost, which is a mixture of rotted leaf-mould (or other organic material) and loamy soil will improve the texture and moisture-retaining properties of a light soil. On the other hand sand applied to clayey soils opens them and permits surface moisture to drain away more quickly. Too much sand will cause a quick drying-out of the soil which will be detrimental to the health of the grass, particularly in dry periods.

Compost forms a rather soft resilient turf, which although not able to withstand very hard wear is quite desirable for golf-greens. Sand has the reverse action in that it makes a very hard turf more suitable for tennis and bowls. Sand and compost should be used with discretion and according to the particular requirements of the soil and turf.

An over-abundance of either top-dressing materials is not recommended, but sufficient for levelling purposes is always permissible. A warning regarding the use of unsterilized compost or sand might here be mentioned. Not infrequently has it been possible to attribute the introduction of weeds to a good, clean lawn, to the use of compost which contains weed-seeds.

LAWN WEEDS(3).

The establishment of weeds in lawns frequently results from seeds which are lying dormant in the surface soil when the grass seed is sown. The majority of these dormant weed-seeds should have been eliminated by allowing them to germinate when the ground was being prepared and levelled.

Lawn-grass seed is usually free from weed-seeds, and if good pure seed is purchased the establishment of weeds in the lawn should be attributed to the presence of weed-seeds in the soil rather than to their presence as an impurity in the grass-seed. Large numbers of the early-establishing weeds are of little consequence except for their smothering effect on grass, as they do not persist long under close mowing conditions.

The great variety of lawn weeds with which the greenkeeper is concerned usually gains entrance to the lawn as the result of the turf being weakened by close continuous mowing and through inattention to the maintenance of the required standard of soil fertility.

For convenience, lawn weeds may be grouped under two general headings—(1) Flat or rosette weeds and (2) mat weeds.

The most common weeds of group 1 are catsear (*Hypochaeris radicata*), ribgrass (*Plantago lanceolata*), hawkbit (*Leontodon hispidus*), hawkweed (*Crepis capillaris*), dandelion (*Taraxacum officinale*), and field daisy (*Bellis perennis*).

Mat weeds of group 2, for convenience, may be further subdivided into (*a*) dense mat weeds and (*b*) loose mat weeds. In the former sub-group are such weeds as pearlwort (*Sagina procumbens*), slender creeping chickweed (*Cerastium vulgatum*), pennyroyal (*Mentha Pulegium*), creeping speedwell (*Veronica serpyllifolia*), moss (various species), and waxweed or shiny pennywort (*Hydrocotyle novae-zealandiae*).

Of the loose matweed group the following are the most common: Onehunga weed (*Soliva sessilis*), suckling clover (*Trifolium dubium*), white clover (*Trifolium repens*), and *Poa annua*.

Close and continuous mowing favours the growth and spread of the above weeds, which, by virtue of their somewhat prostrate growth form, escape severe defoliation such as that to which the grass is subjected.

WEED CONTROL(3).

Although prevention of weed establishment should be the aim, it is difficult to accomplish, and so control and eradication of these undesirable plants become necessary.

It is fortunate that there are very few weeds which do not respond fairly rapidly to poisoning treatments which are both practical and economical.

Annual and perennial clovers and certain of the other weeds are easily and quickly killed by applications of sulphate of ammonia. White clover will require two applications of this chemical in either spring or autumn. Each treatment should consist of an even dressing of sulphate of ammonia at the rate of 300 lb. per acre, or alternatively the application may be made in liquid form, in which case 6 oz. of sulphate of ammonia should be dissolved in 1 gallon of water and this quantity applied with a watering-can to 6 square yards of turf. Sulphate of iron added to the sulphate of ammonia in the proportion of 1 part of the former to 3 parts of the latter substance usually assists in the eradication of clover and certain weeds, and yet minimizes the browning of the turf.

Deviation from the manurial programme recommended is permissible where white clover is competing strongly with the grasses, and instead of applying nitrate of soda for the January and June manurings the substitution of sulphate of ammonia for the nitrate of soda will assist materially in eliminating clover.

During the past seven years experiments have been conducted with arsenic pentoxide spray solution for the eradication of lawn weeds. By using this spray strictly according to instructions almost all weeds can be completely eradicated without any severe permanent injury to the turf grasses. A temporary browning-off of the lawn for from two to three weeks, however, takes place as a result of the arsenic pentoxide treatment (fig. 4).

GENERAL INSTRUCTIONS FOR SPRAYING WITH ARSENIC PENTOXIDE.

Arsenic pentoxide, which is a deadly poison, should be kept in an air-tight tin, as it is very hygroscopic. Danger in using arsenic pentoxide results from careless handling or misuse.

The strength of the spray to be used must be determined by the condition of the turf and the weeds to be eradicated. The required quantity of arsenic pentoxide should be dissolved in a small quantity of water and diluted to the required strength. As the efficiency of arsenic pentoxide decreases rapidly when in solution, it is advisable to prepare only sufficient for use at one time.

A knapsack spray pump of the Holland's Vermorel type, fitted with a trigger release, is the most suitable kind for spraying greens.

FIG. 5.

LEFT. CORRECT MANURING AND SPRAYING—NO INJURY TO GRASSES. RIGHT — TURF GRASSES ALMOST KILLED BY APPLYING ARSENIC SPRAY TO TURF WHICH HAS BEEN LIBERALLY TOP-DRESSED WITH SULPHATE OF AMMONIA ONLY —NO OTHER FERTILIZER USED. [*Photo by H. Drake.*

FIG. 6.—DEAD WORMS ON SURFACE AFTER BLUESTONE TREATMENT.

Note that worms are more numerous on weak open turf on left—no manure. Plot on right treated with sulphate of ammonia and sulphate of iron, both of which are somewhat toxic to worms. [*Photo by E. A. Madden.*

A bucket type of sprayer is not recommended, as the splashing of the spray solution on to the turf will cause permanent injury to the grasses where any spilling takes place.

To ensure convenience in spraying and even distribution of the solution, the area to be sprayed should be divided into strips about 4 ft. wide, using string or binder twine for the purpose. Uneven distribution of the spray, especially the stronger solutions, must be guarded against, and care should be taken to see that the area in close proximity to the string lines does not receive a double dose.

The various strengths of the spray solution are based on the amount of arsenic pentoxide required per square yard to kill specific types of weeds when the spray is applied at the rate of 1 gallon to 20 square yards. The importance, therefore, of the even distribution of the correct strength of spray cannot be over-emphasized.

Lawns which are badly infested with weeds can be improved vastly by treating them as follows: Top-dress during January or February with a mixture of superphosphate and nitrate of soda in equal parts at the rate of 1 oz. per square yard. Substituting sulphate of ammonia for nitrate of soda for this manuring is not advised on account of the severe turf injury which may result from the combined action of the sulphate of ammonia and the arsenic pentoxide (fig. 5).

Weeds of the daisy, ribgrass, catsear type in association with mat weeds require to be treated with a 1–60 arsenic pentoxide solution during late autumn or early spring. When, however, spraying can be undertaken in late summer or early autumn, this is preferred, and in such instances a 1–80 solution will usually give satisfactory results. All spray solutions mentioned are on a weight basis—a 1–80 solution is made by dissolving 1 lb. arsenic pentoxide in 8 gallons of water.

The required strength of spray solution depends largely on the type of weed to be killed and on the condition of the turf. When the soil is moist and all plants are growing vigorously, a stronger solution will be required than when growth is slower on account of dry conditions. Spraying should not be attempted unless the foliage is thoroughly dry, otherwise the free moisture on the weeds will dilute the spray.

Certain weeds may be dealt with effectively by using very dilute spray solutions, and as a guide in this matter it may be mentioned that Onehunga weed requires a 1–180 or 1–200 solution, while suckling clover and slender chickweed, pennyroyal, and pearlwort are invariably killed by a 1–100 or 1–120 solution. These weaker solutions will have very little, if any, effect on the grass, but, on account of the weeds being killed, bare spaces in the turf are to be expected. In such an event raking the bare soil and sowing some seed thereon will soon obliterate the open spaces which were previously occupied by weeds.

Grass-grub Control(4).

In districts where grass-grub infestation is common, or when it has become necessary to resow a lawn on account of its ruination through the depredations of this pest, some preventive measures should be taken to ensure against trouble from the grub.

Cottier(4) has found that a dressing of arsenate of lead powder to the soil prior to sowing the lawn will be effective in keeping the subsequent turf free from grub for several years. The recommendation

in the article cited is that 1½ oz. of arsenate of lead powder per square yard should be incorporated with the soil so that after consolidation this quantity will be well distributed through the top inch or so.

To proof established lawns against grub attack ¾ oz. of arsenate of lead per square yard is required. The arsenate powder should be mixed with twice its volume of slightly moist fine soil and broadcast evenly while the turf is dry. Rubbing the arsenate of lead and soil mixture into the turf with the back of a rake is recommended.

The extermination of grubs already in a turf is a temporary measure only and somewhat difficult to effect. Cottier deals very fully in his article with this aspect of grub control.

The damage to turf through grass grub may be greatly reduced by maintaining a strong vigorous turf, and this can be accomplished best by correct manuring.

Subterranean Grass Caterpillar (Porina Species).

The subterranean grass caterpillar, which lives underground during the day, comes to the surface at night and feeds on the leaves of the grasses. It can cause great damage to a lawn by this surface feeding. The caterpillars vary in colour, but are commonly dark green. Their presence will be detected readily by examining small bare patches on the lawn and looking in close proximity to these patches for holes down which the caterpillars retreat during the day.

On account of the fact that the caterpillar is a surface feeder, extermination of the pest is comparatively simple. The affected area should be sprayed with a suspension of arsenate of lead made by mixing 3 lb. of this poison into 100 gallons of water. The addition of a spreader such as lime-casein at the rate of ½ lb. to ¾ lb. per 100 gallons of spray is advantageous. Sufficient spray to wet all the leaves thoroughly should be applied on a fine calm day.

Earthworms.

Under most circumstances earthworms are considered to be beneficial to the soil, but under lawn conditions it is considered that this is not so. The small mounds of earth (worm casts) which are deposited on the surface cause an unevenness of the turf. Further, in the process of mowing, these casts are rolled out flat and cause a smother which in some instances results in the death of small patches of grass.

Extermination of worms is best accomplished while the soil is moist and the worms are near the surface.

Two methods which have proved satisfactory require the use of bluestone (copper sulphate). In one case powdered bluestone is mixed with twice its weight of clean dry sand, then broadcast evenly at the rate of 1 oz. of mixture per square yard.

Sieving the mixture immediately prior to applying is recommended, as this will prevent any lumps from being deposited on the turf. As soon as possible after broadcasting the mixture the bluestone should be washed off the grass and into the soil by liberal watering. This is essential, firstly, to prevent the burning of the turf and secondly to ensure that the bluestone is washed down to the depths where the worms are most active. This will bring the worms to the surface quickly, where they will die (fig. 6).

The other method of killing worms, which is recommended where copious watering is not possible consists of making a solution of bluestone

and applying this through a watering-can at the rate of 1 gallon per square yard. The solution which proved most effective under trials at Palmerston North was made by dissolving 1 lb. of bluestone in 100 gallons of water. Wooden or copper vessels should be used for bluestone solution.

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PASTURE TOP-DRESSING IN THE AUCKLAND PROVINCE.

EXPERIMENTAL WORK BY FIELDS DIVISION, PERIOD 1928–1934.

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PASTURE top-dressing is an essential practice of intensive grassland farming in the Auckland Province, for, of the 3,900,000 acres of grassland in the province, 1,300,000 acres, forming the bulk of the pastures on ploughed land, are annually top-dressed. The practice of top-dressing started in the "eighties," following the settlement of the Middle Waikato Basin, which brought forward the local problem of grassing light soils of low natural fertility. Early Waikato top-dressing was done with a mixture of superphosphate, bonedust, and rock phosphate, but no extensive top-dressing was done until the dairy industry was properly established early in the present century.

The first cargo of basic slag arrived in New Zealand in 1892, and the fertilizer soon proved its value as a rejuvenator of old pastures. By 1900 top-dressing was becoming a recognized practice in the Waikato, and the fertilizers used were slag or a mixture of equal parts super, bonedust, and rock phosphate. Top-dressing was undertaken to rejuvenate old pastures that were running out, and it was here that basic slag, by promoting an extraordinary growth of white clover, proved to be so efficacious.

In the annual report of the Department of Agriculture for 1904 the following extract is of interest regarding the general condition of pastures in the Waikato: "One of the most, if not the most, disappointing aspects of agriculture in this district is the absence of profitable permanent pastures, except on lands of the most fertile description. At Ruakura there is no old pasture of any stocking capacity." Then, after dealing with the effect of phosphatic fertilizers in improving pastures, the report proceeds: "This would lead up to the idea that in place of the usual routine of roots, grain, and grass for a few years, and the process again

repeated, the grassland should be laid down in the best condition, and having sown the grass conserve it with judicious top-dressing."

It was at this time that the first top-dressing demonstration plots were laid down by the Department of Agriculture, plots being laid down at Waerenga in 1905 and Ruakura in 1904. These plots aroused interest in the practice of top-dressing, and clearly demonstrated the improved pasture production obtained by phosphatic top-dressing.

By 1909 top-dressing was becoming a general practice in the Waikato and South Auckland districts. Basic slag was extensively used, and the importations of slag rose from 4,000 tons in 1909 to 30,000 tons in 1914. During the war top-dressing was still largely practised, but as the war progressed fertilizer importations gradually decreased and supplies of slag were cut off. It was during the war years that superphosphate became increasingly popular as a top-dressing fertilizer.

Between 1919 and 1928 general farming practice and the results of observational top-dressing experiments confirmed the popularity of superphosphate for pasture top-dressing, although on some soils it required the addition of lime to give the best results, and it was generally on the lime-responsive soils that slag and rock phosphates still retained their popularity for top-dressing.

The Auckland Province has always been a large user of raw rock phosphates for grassland top-dressing: in the early days of top-dressing they were mixed with superphosphate, but recently there has been a tendency to use them alone. General farming experience and top-dressing experiments show that they are not as efficient as superphosphate or superphosphate and lime; they are more efficient on heavy soils than they are on light soils, and, although stimulating clovers, do not directly stimulate grass growth.

The Auckland Province contains a very large variety of soil types, and it is only recently that any systematic classification of the soils has been attempted.* As might be supposed fertilizer and lime responses have varied on different classes of land, and an attempt has been made in summarizing the results of these experiments to group very broadly the soil types with the view to later and more systematic examination of the responses on particular types of soil.

PHYSIOGRAPHY OF AUCKLAND PROVINCE.

The long, narrow North Auckland Peninsula extends in a north-westerly direction from Auckland City; it is two hundred miles long, and its greatest breadth is sixty miles. The land surface consists of scattered fragments of mountain ranges, composed mainly of greywacke and volcanic rocks, joined together by hills and rolling downs of claystone, sandstone, and limestone. Here and there, as plateaux on the downs country, occur basaltic lava flows on which are scattered low, steep-sided scoria cones; whilst in the far North and on the west coast are large areas of consolidated sand. A peculiar type of clay soil, known locally as "gumland" soils, occurs in patches throughout North Auckland. The surface soils consist of grey silts and clays and are derived from Onerahi claystones and limestones of late Cretaceous age and from Waitemata and Whangarei sandstones and claystones of Miocene age.†

* Soil Survey, Waipa County: L. I. Grange and N. H. Taylor.

† Gumland Soils of North Auckland: L. I. Grange, *New Zealand Journal of Science and Technology*, May, 1934.

On the south and east of the Lower Waikato Basin lie ranges of greywacke hills, which are finally extended as islands in the Hauraki Gulf. The Waikato River breaks through this range at Taupiri, flowing north from the Middle Waikato Basin. This lower basin of the Waikato consists of rolling downs of claystone and loosely consolidated sands and silts containing much volcanic material, and low-lying areas, being the swampy flood plains of the Waikato and its tributaries. Long sprawling spurs reach out into the flood plain, from which also low rounded hills rise like islands. Lakes are numerous on both sides of the Waikato River. These are all shallow and their surfaces are but little above the normal river level: the outlets are across the wide swampy flats of the present flood plain, and the edges of the lakes remote from the river are bordered by gently rolling hills. The lower basin of the Waikato is bounded on the north and west by basic volcanic hills, which form the chief farming district of this area.

The central volcanic plateau forms the main water-shed of the North Island. Commencing south of Lake Taupo, it stretches across the North Island from the main mountain range on the east to the high elevated marine plain on the west, and extends northwards as far as the Bay of Plenty. Relatively flat over wide areas, the plateau rises here and there into high volcanic cones and flat-topped hills and serrated ridges. Rhyolite lava flows and large masses of pumice-stone form the tableland, and the numerous volcanic cones that occur throughout its extent are built up of rhyolite, andesite, and partly also of basalt.

Lake Taupo is everywhere surrounded with volcanic rocks which form a high tableland from 2,000 ft. to 2,200 ft. above the level of the sea, and upon which numerous volcanic cones arise. The Waikato River leaves Lake Taupo at the north-east end and shapes its course north-east for a distance of twenty miles, flowing through a broad terraced valley on the boundary of the Kaingaroa Plain. After its junction with the Waiotapu River the Waikato makes a sharp turn to the west, flows through a mountainous region in a deep gorge, and emerges near Maungatautari, in the broad plain of the Middle Waikato Basin. This is a large area of flat land extending from the coastal range on the west of the Waipa to the high volcanic country in the south and east, and extending northwards to the Firth of Thames. The plain is crossed by a low range of hills which separate the plains of the Waikato and Waipa from the plains of the Piako and Waihou Rivers, which empty into the Hauraki Gulf. The land of the plains consists of low rolling hills of loosely consolidated sand and silts, containing much volcanic material, flat areas of recent water-borne pumice brought down by the Waikato River from the neighbourhood of Lake Taupo, and large peat swamps.

The south-western portion of the Auckland Province covers part of the western elevated marine plain—of limestone, sandstone, and calcareous claystone hills. Considerable areas of these have been covered by volcanic ash showers from the central volcanic plateau, and these later ash-showers have also covered portions of the low rolling hill country of the Middle Waikato Basin.

Responses to Lime, Superphosphate, and Potash.

The main top-dressing experiments laid down between 1928 and 1934 have aimed at securing data regarding the response from lime,

superphosphate, and potash on various types of soil. The plots were generally treated as follows: (1) carbonate of lime, 1 ton per acre; (2) superphosphate, 3 cwt. per acre; (3) 30 per cent. potash salts, 2 cwt. per acre. On some plots the initial dressing of lime was 25 cwt., and was not subsequently supplemented with further dressings: other plots have received further annual dressings of 5 cwt. per acre. Superphosphate and potash salts, after the initial dressings, were applied annually at the rate of 3 cwt. superphosphate and 2 cwt. of 30 per cent. potash salts per acre.

The arrangement of the plots was such as to give the following treatments and combinations of treatments:—

(1) No manure.
(2) Superphosphate.
(3) Superphosphate plus potash.
(4) Potash.
(5) Lime.
(6) Lime plus superphosphate.
(7) Lime plus superphosphate plus potash.
(8) Lime plus potash.

The above arrangement indicates the relative positions of treatments as they occurred in most of the experiments, which, for the sake of brevity are referred to as L.P.K. experiments, L being used to indicate lime, P and K being the chemical symbols for phosphorus as represented by superphosphate and potassium as represented by 30 per cent. potash respectively.

The early experiments of this series also included applications of sulphate of ammonia, applied at the rate of 1 cwt. per acre: subsequently these dressings were discontinued. The responses from sulphate of ammonia were fair to good for short periods only, but the after effect was bad—white clover was weakened and pasture growth depressed.

The responses to fertilizer treatment are given in Table 1, and the method adopted to indicate the nature of the differences has been to award points as follows: 0, no visible response; ?, doubtful; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response. In most experiments the effect of phosphates was probably less pronounced than it would have been had the pastures not received regular phosphatic dressings prior to the experiments being laid down.

The experiments have been roughly classified according to soil types (1) sandy loams, (2) loams, (3) silts, (4) clay soils.

SANDY LOAMS (RHYOLITE).

The soils on experiments numbered 1 to 21 in Table 1 are light, free-working soils and vary from white sands to reddish sandy loams. They have been formed from water-borne pumice or ash showers from the Central Plateau, and cover large areas of land in the Bay of Plenty, Central Plateau, King Country, and Middle and Lower Waikato Basins.

The soils are naturally of low fertility, being deficient in phosphoric acid and nitrogen, but since the adoption of the practice of pasture top-dressing they have proved capable of carrying first-class rye-grass-cocksfoot-white-clover pastures—superphosphate has supplied the phosphoric acid and white clover the nitrogen.

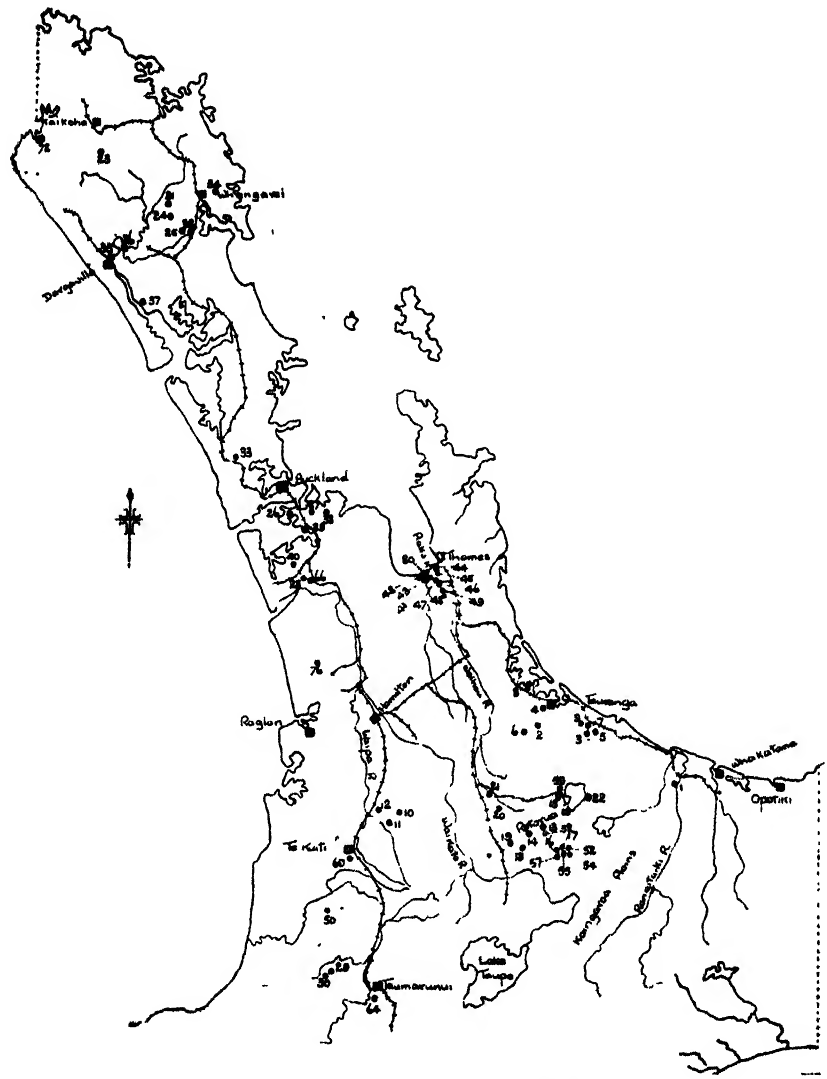

FIG. 1. LOCATION OF EXPERIMENTS.

Map of Auckland District showing location of experiments to which reference is made in Tables 1 and 2.

NOTE.—Apart from the instances specified below the numbers on the map correspond with the numbers of the experiments as given in Tables 1 and 2. Below experiment numbers precede their respective map numbers, which are given in brackets: 51 (35), 53 (16), 56 (17), 60 (7), 61 (9), 62 (3), 63 (1), 65 (28), 67 (29), 68 (30), 70 (32), 71 (32), 73 (35), 74 (35), 75 (40), 77 (42), 78 (43), 79 (41).

The pasture swards on the trials on these soils varied from first-class perennial rye-grass-cocksfoot-white-clover swards, which produce in the vicinity of 175 lb. of butterfat per acre to ones which produce only from 75 lb. to 100 lb. of butterfat per acre and on which rye-grass shared dominance with inferior grasses such as Yorkshire fog, sweet vernal, and goose grass. Table 1 shows that superphosphate alone has given a fair to excellent response, and there has been a general lack of response to lime and potash, although in a few instances small but appreciable responses have been obtained from lime. It can be said, however, that on these light soils formed of pumice and ash showers from the Central Plateau lime and potash responses so far have been negligible, and lime is not necessary to get good results from superphosphate. The superphosphate responses have varied from fair (2) to excellent (5): the variation in response is due mainly to the pasture sward, as on good pastures superphosphate gives a more marked response than on poor ones.

LOAMS (BASALT).

The soils on experiments numbered 23 to 28 in Table 1 are friable brown or red soils, known locally as "volcanic land." They occur on areas in North and South Auckland covered by basaltic lava flows and scoria cones. The soils vary in age, texture, and fertility. The soils are generally productive and closely settled, but in parts of Bay of Islands and Hobson Counties there are areas of "poor" volcanic land—viz., the "ironstone" soils in parts of Bay of Islands County have a rubbly surface of limonite pebbles beneath which is a thin layer of poor soil: the soil permits a too rapid percolation of rain water and has too high an iron content for the successful growth of pasture plants.* There are also in Hobson County areas of light "volcanic" land which are excessively dry. With these exceptions the volcanic soils are of good natural fertility, their chief drawback being a tendency to dry out badly in the summer. Pastures consist of rye-grass, cocksfoot, and white clover, with a fair amount of paspalum in parts of North Auckland. Rib-grass is a common weed, and subterranean clover occurs in many pastures.

In addition to the six L.P.K. trials shown in Table 1, there were eight lime and potash plots placed on phosphated grassland—in four of these lime gave a response and in five there was a slight or questionable response from potash. In four of the L.P.K. trials lime alone gave a definite response, whilst in two the response was doubtful. In the six L.P.K. trials, potash gave either no response or the response was doubtful.

SILTS.

The soils in experiments 31 to 33 in Table 1 are grey gumland silts—acid soils of low fertility which have developed under conditions favouring intense leaching. These soils are popularly known as "pipeclay" soils, and have been extensively dug over for kauri-gum. The three experiments show that there is a response to lime, and that a mixture of superphosphate and lime is more efficient than superphosphate alone: they also show a slight response to potash.

In developing these poor gumland soils the process is to fill the holes left by gum-diggers, drain, and plough: the ploughed land requires at

* Ironstone Soils of North Auckland: L. I. Grange, *New Zealand Journal of Science and Technology*, July, 1934.

least a six months' fallow, and to secure a satisfactory seed-bed the land is best twice ploughed. Before sowing grass, ground limestone should be applied at the rate of 1 ton per acre and the grass mixture used should consist of perennial rye, paspalum, and white clover, and the grass-seed should be sown along with from 3 cwt. to 4 cwt. of superphosphate or basic slag. Thereafter the pastures require annual dressings of 3 cwt. of superphosphate or slag. A moist, well-consolidated seed-bed is essential for a good "take" of white clover, and successful pasture establishment depends as much on careful cultivation as on the fertilizers and lime used.

CLAYS.

Experiments 35 to 50 in Table 1 are on recent alluvial clay soils, and responses to fertilizers vary considerably. They are all on land of high fertility carrying either rye-grass, cocksfoot, white clover pastures or paspalum, rye-grass, and white clover. The soils in Hauraki Plains show no responses to lime, superphosphate, or potash: the land is of high fertility and it is possible for slight increases to occur which are not visible to the eye. Top-dressing is not practised on these rich alluvial soils, and it is obvious that fertilizers do not give any marked increases in growth. On other clay soils there is a fairly general response to lime and superphosphate, and a doubtful or slight response to potash.

RESPONSES TO SUPERPHOSPHATE, SUPERPHOSPHATE AND LIME, SLAG, AND ROCK PHOSPHATES.

The results of another series of trials are shown in Table 2: these trials have aimed at securing data regarding the comparative efficiency of superphosphate, superphosphate and lime, slag, superphosphate and slag, and rock phosphates on different types of soil. The phosphates or mixtures of phosphates were applied at the rate of 3 cwt. per acre and the lime generally at 1 ton per acre. The method of awarding points to measure differences, outlined above, has again been used. Superphosphate and basic slag appear to be generally equally efficient as top-dressing fertilizers: in some trials, superphosphate and lime is superior to superphosphate, and the superior results secured by the use of superphosphate-slag mixture over superphosphate alone or slag alone are interesting. In most trials the rock phosphates were inferior to superphosphate or slag.

CONCLUSIONS.

The results of the top-dressing trials detailed in Tables 1 and 2 confirm general farm practice Superphosphate is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime. Rock phosphates are generally inferior to superphosphate or slag. Potash responses are not frequent, and, where responses are secured, they are generally slight.

ACKNOWLEDGMENTS.

The field work of these experiments was carried out by Instructors in Agriculture C. J. Hamblyn, E. B. Glanville, J. E. Bell, and C. Walker, and Fields Instructors R. P. Hill, J. F. Shepherd, and C. S. Dalgliesh: they supplied the writer with the information on which this description of the top-dressing experiments has been prepared. The writer also wishes to acknowledge assistance received from Crop Experimentalist Mr. A. W. Hudson in the establishment and supervision of these experiments. Thanks are due to the numerous farmers who placed fields at the disposal of the Department for the experiments.

Table 1.—Responses to Fertilizers.

Experiment No.*	County.	Soil Type.	Responses to Fertilizers · 0, No Response; ?, Doubtful; 1, Slight; 2, Fair; 3, Good; 4, Very Good; 5, Excellent Response.					
			Lime.	Super.	Potash.	Lime-super.	Super-potash.	Lime-Super-Potash.
1	Whakatane ..	Sandy loam†	0	3	0	3	3	3
2	Tauranga ..	Sandy loam†	0	3	0	3	3	3
3	Tauranga ..	Sandy loam†	0	3	?	3	3	3
4	Tauranga ..	Sandy loam†	0	3	0	3	3	3
5	Tauranga ..	Sandy loam†	2	3	0	4	3	4
6	Tauranga ..	Sandy loam†	1	3	0	4	3	4
7	Tauranga ..	Sandy loam†	1	2	0	2	2	2
8	Tauranga ..	Sandy loam†	0	3	?	3	3	3
9	Tauranga ..	Sandy loam†	?	2	0	3	2	2
10	Otorohanga ..	Sandy loam†	0	2	0	2	2	2
11	Otorohanga ..	Sandy loam†	0	2	0	3	2	3
12	Otorohanga ..	Sandy loam†	?	2	0	2	2	2
13	Rotorua ..	Sandy loam†	0	5	?	5	5	5
14	Rotorua ..	Sandy loam†	−2	2	?	3	3	3
15	Rotorua ..	Sandy loam†	1	2	?	2	3	3
16	Taupo ..	Sandy loam†	1	3	?	3	3	3
17	Taupo ..	Sandy loam†	1	3	?	3	3	3
18	Matamata ..	Sandy loam†	−?	3	0	3	3	3
19	Matamata ..	Sandy loam†	−1	3	?	3	4	4
20	Matamata ..	Sandy loam†	1	3	−1	3	3	3
21	Matamata ..	Sandy loam†	1	4	?	4	5	5
22	Rotorua ..	Loam‡ ..	1	3	1	3	3	3
23	Bay of Islands	Loam§ ..	2	2	0	4	3	4
24	Whangarei ..	Loam§ ..	1	2	?	3	3	4
25	Whangarei ..	Loam§ ..	2	2	?	3	1	3
26	Manukau ..	Loam§ ..	?	1	0	1	1	1
27	Manukau ..	Loam§ ..	3	2	?	4	2	4
28	Franklin ..	Loam§ ..	?	?	..	1	?	1
29	Ohura ..	Loam ..	1	3	1	3	3	3
30	Ohura ..	Loam ..	1	3	0	3	3	3
31	Whangarei ..	Silt‖ ..	1	2	1	3	2	4
32	Whangarei ..	Silt‖ ..	0	2	1	4	3	4
33	Waitemata ..	Silt‖ ..	1	1	?	2	3	5
34	Whangarei ..	Clay ..	4	1	?	5	1	5
35	Hobson ..	Clay ..	0	3	0	3	3	3
36	Hobson ..	Clay ..	2	1	1	3	3	3
37	Hobson ..	Clay ..	1	2	1	3	3	3
38	Manukau ..	Clay ..	3	?	?	3	?	3
39	Manukau ..	Clay ..	1	1	0	2	1	2
40	Franklin ..	Clay ..	3	1	..	4	1	4
41	Hauraki Plains	Clay ..	0	0	0	0	0	0
42	Hauraki Plains	Clay ..	0	0	0	0	0	0
43	Hauraki Plains	Clay ..	0	0	0	0	0	0
44	Hauraki Plains	Clay ..	0	0	0	0	0	0
45	Hauraki Plains	Clay ..	0	0	0	0	0	0
46	Hauraki Plains	Clay ..	0	0	0	0	0	0
47	Hauraki Plains	Clay ..	0	0	0	0	0	0
48	Hauraki Plains	Clay ..	0	0	0	0	0	0
49	Hauraki Plains	Clay ..	0	0	0	0	0	0
50	Waitomo ..	Clay ..	1	2	1	2	2	2

* Experiments: (1) 16/1/124, F. Reynolds, Edgecumbe; (2) 16/1/139, L. P. Jensen, Omanawa; (3) 16/1/121, J. W. Mutton, Te Puke; (4) 16/1/140, Ridder Bros., Tauranga; (5) 16/1/176, J. Courtney, Te Puke; (6) 16/1/162, Wilson Bros., Lower Kaimai; (7) 16/1/201, D. Donovan, Te Puke; (8) 16/1/141, C. O. Bayley, Omokoroa; (9) 16/1/120, W. Bennett, Te Puke; (10) 16/1/173, Walters and Sons, Otorohanga; (11) 16/1/172, H. A. Lurman, Otorohanga; (12) 16/1/170, H. Gall, Otorohanga; (13) 16/1/156, Ngakuru Block 1, Rotorua; (14) 16/1/191, R. H. Hill, Atiamuri; (15) 16/1/210, R. Dawson, Rotorua; (16) 16/1/188, T. N. Forrest, Reporoa; (17) 16/1/190, G. G. Seccombe, Reporoa; (18) 16/1/207, H. L. Pearson, Tokoroa; (19) 16/1/203, R. Thompson, Tokoroa; (20) 16/1/209, C. G. Penwarden, Putaruru; (21) 16/1/189, A. R. Vosper, Putaruru; (22) 16/1/206, R. Copeland-Smith, Rotorua; (23) 16/1/160, A. Laird, Awarua; (24) 16/1/180, H. W. Ellis, Maungatapere; (25) 16/1/184, F. Walker, Maungakaramea; (26) 16/1/178, E. C. Montgomery, Mangere; (27) 16/1/177, R. Bell, East Tamaki; (28) 16/1/198, R. F. Wilkinson, Pukekohe; (29) 16/1/142, J. McAvady, Matiere; (30) 16/1/143, F. Pleasants, Matiere; (31) 16/1/181, Kokich Bros., Kokopu; (32) 16/1/94, Puwera Experimental Area, Puwera; (33) 16/1/147, R. Matheson, Waimauku; (34) 16/1/183, P. Hoban, Whareora; (35) 16/1/98, Northern Wairoa Experimental Farm, Dargaville; (36) 16/1/185, P. Hill, Hoanga; (37) 16/1/132, Glen Robson, Ruawai; (38) 16/1/169, J. H. Faulconbridge, Manurewa; (39) 16/1/167, F. D. Clayton, Manurewa; (40) 16/1/195, Pearson Bros., Patumahoe; (41) 16/1/103, F. E. Hale, Kopuarahi; (42) 16/1/104, D. McCauley, Pipiroa; (43) 16/1/105, Ganley and Galvin, Pipiroa; (44) 16/1/133, W. J. Nash, Orongo; (45) 16/1/134, A. B. Corbett, Orongo; (46) 16/1/135, A. Peate, Orongo; (47) 16/1/136, A. H. Rodgers, Orongo; (48) 16/1/137, L. Durman, Kerepeehi; (49) 16/1/138, J. Spence, Ngatea; (50) 16/1/171, E. Tolme, Aria.

Table 2.—Responses to Fertilizers.

Experiment No.*	County.	Soil Type.	Response to Fertilizers: 0, No Response; ?, Doubtful; 1, Slight; 2, Fair; 3, Good; 4, Very Good; 5, Excellent Response. Super.	Super-lime.	Slag.	Super-slag.	Nauru.	North African Phosphate.
51	Hobson ..	Sand ..	2	3	3	..	..	1
52	Taupo ..	Sandy loam†	3	..	3	4	..	..
53	Taupo ..	Sandy loam†	3	..	2	4	..	..
54	Taupo ..	Sandy loam†	3	..	3	3	..	..
55	Taupo ..	Sandy loam†	3	..	2	3	..	..
56	Taupo ..	Sandy loam†	3	..	3	3	..	..
57	Taupo ..	Sandy loam†	3	..	3	2	..	..
58	Rotorua ..	Sandy loam†	4	..	..	..	..	2
59	Rotorua ..	Sandy loam†	2	3	3	..	1	1
60	Tauranga ..	Sandy loam†	2	3	2	..	..	2
61	Tauranga ..	Sandy loam†	2	3	3	..	..	2
62	Tauranga ..	Sandy loam†	3	3	3	..	..	2
63	Whakatane ..	Sandy loam†	3	3	3	..	..	2
64	Taumarunui ..	Sandy loam†	3	3	2	..	..	1
65	Franklin ..	Loam‡ ..	1	2	2	..	1	1
66	Franklin ..	Loam‡ ..	4	4	2	..	..	2
67	Ohura ..	Loam ..	3	3	2	..	..	2
68	Ohura ..	Loam ..	3	3	3	..	..	2
69	Waitomo ..	Loam ..	3	4	2	..	1	..
70	Whangarei ..	Clay ..	2	3	3	4	..	1
71	Whangarei ..	Clay ..	2	3	2	3	..	1
72	Hokianga ..	Clay ..	3	..	4	..	1	..
73	Hobson ..	Clay ..	3	3	3	..	..	1
74	Hobson .	Clay ..	3	3	3	..	..	1
75	Franklin ..	Clay ..	2	4	3	..	1	2
76	Raglan ..	Clay ..	3	4	3	..	..	3
77	Hauraki Plains	Clay ..	0	0	0	..	..	..
78	Hauraki Plains	Clay ..	0	0	0	..	..	..
79	Hauraki Plains	Clay ..	0	0	0	..	..	..
80	Hauraki Plains	Clay ..	0	0	0	..	..	..

* Experiments: (51) 16/1/98, Northern Wairoa Experimental Farm, Dargaville; (52) 16/1/112, A. J. Gillanders, Reporoa; (53) 16/1/111, T. N. Forrest, Reporoa; (54) 16/1/114, E. Forster, Reporoa; (55) 16/1/113, W. W. Meikle, Reporoa; (56) 16/1/115, G. G. Seccombe, Reporoa; (57) 16/1/110, H. A. Alexander, Reporoa; (58) 16/1/83, W. Gill, Guthrie; (59) 16/1/215, Smyth Bros., Ngongotaha; (60) 16/1/201, D. Donovan, Te Puke; (61) 16/1/120, W. Bennett, Te Puke; (62) 16/1/121, J. W. Mutton, Te Puke; (63) 16/1/124, F. Reynolds, Edgecumbe; (64) 16/1/11, C. Osborne, Makokomiko; (65) 16/1/198, R. Wilkinson, Pukekohe; (66) 16/1/81, I. A. Motion, Pukekohe; (67) 16/1/142, J. McAvady, Matiere; (68) 16/1/143, F. Pleasants, Matiere; (69) 16/1/15, C. Harrison, Te Kumi; (70) 16/1/95, Puwera Experimental Farm, Whangarei; (71) 16/1/94, Puwera Experimental Farm, Whangarei; (72) 16/1/69, E. Underwood, Oue; (73) 16/1/96, Northern Wairoa Demonstration Farm, Dargaville; (74) 16/1/97, Northern Wairoa Demonstration Farm, Dargaville; (75) 16/1/195, Pearson Bros., Patumahoe; (76) 16/1/75, G. A. Eyre, Pepepe; (77) 16/1/104, D. McCauley, Pipiroa; (78) 16/1/105, Ganley and Galvin, Pipiroa; (79) 16/1/103, F. E. Hale, Kopuarahi; (80) 16/1/109, J. A. Mangan, Pipiroa.

† From rhyolite.

‡ From basalt.

Tung Oil.—The planting-out of further areas in tung-oil trees in the North Auckland District has been steadily proceeding during the year. It is estimated that the total area now planted is between 3,000 acres and 4,000 acres. As mentioned in my previous report it is not possible to give any indication as to the success or otherwise of this venture until the trees reach a bearing stage and nuts are available for analysis and testing. The importance of adequate shelter for the satisfactory growth of the plants is a feature that is now being more realized by the companies operating.—*Report, Director, Horticulture Division.*

GRADING AND MARKING OF BUTTER AND CHEESE BY OVERSEAS COUNTRIES.

G. M. VALENTINE, Assistant Director, Dairy Division, Department of Agriculture, Wellington.

A CLOSER knowledge of the systems of grading dairy-produce which are in use in other exporting countries leaves one with a feeling that the methods followed in New Zealand reach a standard which is simple and efficient and gives very little room for complaint from those who have to handle our butter and cheese at the consuming end.

The following facts, which were noted in the various countries visited, all have some feature which has no doubt been adopted to suit local conditions.

BUTTER.

The two systems generally in vogue are the one followed in our own country, and that which is done by calls at irregular intervals for samples to be sent in for examination. The latter has the disadvantage that when the examination shows that the butter is of high quality it is assumed that the whole output until the next examination is of the same standard. When the quality is poor the matter is followed up. There is also a system which is a combination of both —viz., that in use in the Irish Free State.

Northern Ireland.—The export trade from Northern Ireland is comparatively small, and lasts for only a short season during the summer months. The butter is graded by surprise calls to the factory for two rolls of butter which are examined in Belfast by judges chosen from a panel of merchants who grade it for flavour and body. Only three grades are employed. Three successive scores of the highest grade entitle the factory to use a Government mark, and three failures to reach that standard result in the withdrawal of the right to use the mark.

There is also an unofficial grading of butter at the Central Railway-station, Belfast, on the arrival of the butter on two days of each week. This grading is controlled by a committee of merchants and creamery managers, and the grading is carried out, on request of the consignee, by two merchants and the secretary of the committee, one box from each churning being examined. Butter graded " Premium " is stamped with a special mark.

Irish Free State.—Butter-grading was established at the Cork Butter Exchange in 1769 on a voluntary basis, and in 1903 a system of surprise inspections was organized by the State. In 1924, the Dairy Produce Act brought in a system of dairy instruction and grading and general supervision of the industry which in most respects is on similar lines to our own, but also retains the surprise inspections.

A distinction is made between creamery butter and factory butter. The former is butter made in a creamery, and factory butter is farm butter which has been blended in a factory. Out of a maximum of 60 points for flavour and 30 points for texture, creamery butter must score 54 and 24, and factory butter 50 and 20 points to qualify for export.

Under the surprise inspection scheme two boxes of butter are selected and sealed in the factories by the inspectors, and these must be despatched within two days to the butter station in Dublin. It may be of interest to mention that the boxes known in the trade as the "pyramid" are made of half-inch North European pine, are wider at the top than at the bottom, and have both top and bottom square in shape.

Before grading, the butter is held for ten to fourteen days at room temperature. Then, the brands being covered, it is examined by three inspectors, each working independently. The scores are averaged and if there is a big discrepancy in the scores allotted by the individual inspectors a further examination is made in company.

The points scored are flavour 60 points; texture 30 points; colour 5; and finish 5. The butter is also weighed and tested for water, salt, yeasts, moulds, bacteria, &c., and is then returned to the factory for examination by the manager. All the results are published, but the names of only the highest scoring factories are given.

As the high duty practically prohibits the importation of butter into the Irish Free State, and the winter make is only about 4 per cent. of the summer make, estimates of the winter requirements are made in October each year, and the export ceases after a given date.

Examinations of the butter held over for winter consumption are thus made possible, and it is claimed that a pH value of 6·7 has given the best results in these storage trials. As no starter is used in the manufacture of the butter, and all the cream is skimmed from whole milk, there is no developed acidity, and the graders are very definite that Irish butter made with starter would not keep as well as that made without it.

The wash water of each factory is examined once each year, the samples being taken by the inspectors.

Denmark.—Butter is graded in Copenhagen at the State Agricultural Experimental Laboratory each Monday morning. Voluntary grading was started as early as 1889, but was made statutory and compulsory in 1911.

The grading is carried out by six merchants and three managers, divided into three groups working in separate rooms, and presided over by an instructor, the Irish system of scoring independently and then averaging being followed. Fifteen points is the maximum and cover chiefly flavour and body, though uneven colour or gritty salting is penalized. One cask on the day of my visit was scored 14 points by the instructor in charge but was reduced to 12·9 points on the average. This was a nice full-flavoured but mild butter, without that metallic character which is characteristic of some high-acid Continental butters.

The factory is notified by telegram when butter is to be sent in, and must at once forward one cask which is already packed. It is then held for approximately fourteen days, the time which would normally elapse before use. The casks are covered, as also are the paper slip showing the date of manufacture, and the cypher mark of the factory, which is placed on the butter at each end of the cask. The cypher marks are constantly changed, and the slips are issued by a Government institution which keeps a record of the numbers

and can thus establish the identity of the factory using them. They are so thin that it is practically impossible to remove them from the butter without tearing them. This butter is bought from the factories at the current price. The date of manufacture is placed on the two Lur-branded staves, which are sold to the dairy companies by the Ministry, and which are placed opposite each other in every cask. The object of placing the date of manufacture on the containers is to enforce a weekly clearance of the butter in the freshest possible condition.

Should the butter not be up to the "Lur" standard another cask is called for immediately, and the factory is advised to consult the instructor for the district. If this is not done, and the fault is not remedied, the right to use the Lur brand is withdrawn, and the police are ordered to remove and withhold all Lur-branded packing and control slips, &c., at the dairy. As butter which does not bear the Lur brand cannot be exported, the local market is the only one open to a factory without authority to use the Lur brand.

The curd content of the butter is under 1 per cent., and the salt about 1 per cent.; and an argument which took place between the merchant representatives and the instructor during the luncheon following the grading referred to the salt content: the merchants held that more salt could be used with advantage for the North of England, and the instructor argued that it would spoil the flavour of the butter.

As a means of providing an indication of the quality of the butter made by each factory, the Danish system falls far short of the New Zealand practice of examining every churning, as it is assumed under the Danish system that all butter made between one scoring and the next will be of even standard—the number of examinations of the butter of each factory is said to average about three yearly except in those cases where the quality is poor. On the other hand, it is probable that the system on which the factories are run, involving a whole-milk supply, a restricted area from which the milk is drawn, and a comparatively small output, makes for more even results from day to day in comparison with New Zealand conditions. There is also the fact that generally, the butter does not undergo a long storage period.

In addition to the grading, there is a voluntary "warehouse test" which has been introduced during recent years, and which is availed of by 75 per cent. of all dairies. The exporters take a sample of about 3 lb. of butter of each dairy and hold it for fourteen days. At the end of this time it is examined by the dairy representatives and, where possible, by an instructor. The results of the examination, which are sent to the State Agricultural Experimental Laboratory, indicate the dairies where the quality is not being maintained.

In addition to the grading, a system of inspection of dairy-produce is carried out by eleven inspectors controlled by the Chief Inspector of the Government control service, and this inspection seems to take the place of grading in European dairying countries other than Denmark. It is not a guarantee of quality so much as one of purity, and does not cover every churning as does the New Zealand system.

Check weighings are carried out and samples for analysis are taken at any point, at the dairies, in warehouses, on rail, and at the ports, which may be convenient to the inspectors. Moreover, the Government control service is familiar with the output and despatch days of the dairies and knows literally to the hour when the dairy's butter should arrive at the railhead, &c.

In addition to checking the composition of the butter, samples of cream, buttermilk, and skim milk, numbering some thousands yearly, are tested to check the temperature of pasteurization, which must be at least 176° F.

Holland.—There is no official grading of butter in Holland, although a national brand is in use, as it is in practically all European exporting countries.

Private grading for the purpose of distribution to the various markets and subsequent payment to the factories is carried out by the co-operative marketing associations, such as the Frico in Leeuwarden, which controls the outputs of some forty factories situated in Friesland. Flavour and body are noted, and, owing to the difficulty of making a good body in Holland—more importance is attached to body, perhaps, than to flavour—it is the practice in that country to leave the butter in the cask during summer weather.

In addition to the Government instructors, the Frico has three instructors working among their factories, and the butter is sent in as soon as it is made and is stored at the depot in Leeuwarden and shipped to Britain twice weekly.

The National Co-operative Society at Amsterdam markets the butter and milk powder for some eighty-odd factories outside of Friesland, and has three collecting and shipping centres.

The butter control stations in Holland were established for the purpose of guaranteeing the purity of the butter made in that country, and the Government mark placed in each cask gives a guarantee of purity—it is not an indication of quality.

There are nine control stations and a letter is allotted to each. The paper slips issued to each station include this letter and also cypher marks indicating the factory to which they are issued by the control station.

Although the stations are voluntary organizations they have been supervised since 1904 by the Government dairy inspection service, and the statutes or amendments to statutes under which they operate require ministerial sanction before they can be adopted. About 90 per cent. of the butter made in 1927 was controlled. The control was established in the first instance to prevent the adulteration of the butter with margarine, but fat-content and water-content are now taken into consideration, and members " must not have ready for supply butter containing more than 15½ per cent. of water," though a margin up to 16 per cent. is allowed.

Reliance was at first placed on chemical analysis for determining the addition of foreign fat, but it was found that by this method butter which was pure was sometimes condemned, owing to the variation in the composition of the butter made at different factories, and at the different seasons of the year. The practice now followed is to take samples of butter and cream from each factory at least twice monthly at irregular intervals. The cream

is churned at the control station, and the analysis of the cream and of the butter made from it is taken as a basis of comparison to determine the purity of the butter made by the factory.

For the purpose for which the control stations were established, the organization is a thorough one, falling short only in the point that every churning is not examined, but its first purpose was to deal with a phase of the industry which has never developed in New Zealand—namely, adulteration of butter with foreign fats.

Britain.—Owing to the large imports of butter and cheese to Britain the amount produced within the country is generally overlooked, but the output of one butter-factory visited was at the time of the visit about 10 tons daily, and the turnover amounted to 1,000 boxes daily, including blends and pats of imported butters.

It seems obvious that the milk marketing boards will be forced to undertake the manufacture of butter in order to handle their surplus milk, and arrangements have been made already by the Ministry of Agriculture for a national-mark scheme for creamery butter, to be put into operation during the present year in England and Wales. Details of the scheme are not yet available, but they include provision of satisfactory plant and equipment, inspection of the hygienic condition of same, and production of butter of a standard quality, defined as follows: Clean in flavour, firm and neither greasy nor oily, even in colour, bright and clean in appearance, and showing no free moisture. Butter which complies with this standard will be classed "selected" and can bear the national mark which is in general use for home-grown produce of the highest quality. The national mark is a map of England and Wales with a design representing the Union Jack, &c.

CHEESE.

Britain.—In 1933 a grading scheme for Cheshire cheese of both farm and factory make was introduced in England and Wales: under the scheme the farm cheese is graded on the farms by the official grader of the Cheshire Cheese Federation, which controls the scheme under ministerial supervision. One cheese of each day's make is examined, the day's output is then stamped with the grade and date of examination, and this entitles the owner to affix the national mark and the grade which may be "selected" or "extra selected."

Factory cheese is graded in the factory by an official of the Ministry, one cheese from each vat being examined: the stamping and marking is carried out in the same manner as in the case of farm cheese. Only full-cream cheese is graded. The premises of the manufacturer are subject to inspection by the grader.

The influence of the grading is indicated by the prices obtained for the cheese, as graded lines are generally quoted at several shillings above ungraded lines in the cheese fairs. The suggestion has been made from time to time that the grading should be extended to cheddar cheese, and with the manufacturing now largely in the hands of the milk boards it is probable that such a step will be taken.

Irish Free State.—The importation of cheese into the Irish Free State is prohibited. The total manufacture is in the vicinity of

1,000 tons per year, and the consumption about three-quarters of a pound per head yearly, so that it is a very minor branch of the dairy industry.

Denmark.—The cheese industry in Denmark is not an important one when compared with butter, and the manufacture was not subject to control until 1921. In 1933 the total output of cheese was 31,258 metric tons, of which 67 per cent. was consumed at home. The principal variety is Gouda, which is made in four different classes from full-cream down to 10 per cent. of fat in the dry matter. The water content is specified and ranges from 50 per cent. in full-cream cheese to 60 per cent. in the cheese containing 20 per cent. fat in the water-free substances.

Immediately on being made all hard cheese must be marked at the dairy with an indication of the minimum fat content in the dry matter, and the control number of the dairy. This is done by affixing casein discs to the rind during pressing. The discs for the purpose are supplied by the control department, and are perforated to make them adhere to the cheese, and also to make it almost impossible to remove them without destroying them. Thus 30 per cent. plus would indicate that the fat in the water-free substances is more than 30 per cent. They must also be marked with the calendar week of the year.

The work of the control department is to check up the composition of the cheese for comparison with the attached disk, and as there are nine different types of cheeses, each with a different fat and water content, the necessity for this check will be readily understood. Of the 1933 output, only 37 per cent. was full-cream cheese. As in the case of butter, the control is in the hands of the State. It does not involve a grading for quality.

Holland.—In Holland the output of cheese is much greater than that of butter, the figures for 1933, which were supplied by the Department of Agriculture at The Hague, being 120,000 tons of the former and 80,000 tons of the latter. As in Denmark, a large percentage of the cheese is made from partly skimmed milk, and the control was established for the purpose of guaranteeing the classification as marked on the cheese. The two principal varieties are Gouda, which takes its name from the town of Gouda in South Holland, round which is the chief cheese-making area for that variety, and Edam, which originated in the district of that name further north, and to the south of the Zuyder Zee. Both varieties were originally made on the farms, but are now made in factories also, and in several grades of fat-content.

It is claimed that the full-cream farm-made Gouda cheese is the highest quality made in Holland, and in 1906 the first cheese control station was established in South Holland. In 1913 a ministerial decree was issued adopting the existing mark as a Government mark for whole-milk cheese.

A second control station followed later. These stations are owned by the farmers but are supervised by the Government, and membership is voluntary. In 1927 5,602 farms were under the control of these two stations, which employed seventy-two officials. The whole of the expenses of these stations is found by the farmers, but the

instruction work is supervised by the Government, and the checking of the fat-content of the cheese is done by the control stations, which also issue the casein disks which indicate the class of cheese, the cypher marks showing the control station from which it was issued, and from the records the person to whom it was issued and the date of manufacture can be traced. Members must submit to strict supervision by the control officials, and must undertake to make their cheese twice daily immediately milking is finished, and to remove no fat from the milk. Between the hours of manufacture no cream or skim milk is allowed on the farm, and a separator may not be used. Complete records of manufacture must be kept.

"Volvet" or full-cream cheese is guaranteed to contain 45 per cent. of fat in the water-free substances, but 46 per cent. is actually required at the time of making, and, if made only once daily, 48 per cent. of fat in the water-free substances is required. The actual average is nearly 50 per cent.

With the advent of the factory system the manufacture of part-skimmed cheese extended, due it is said to the fact that the percentage of fat in the milk in some districts, and in the mixed milk supplied to some factories, was higher than the milk of some single herds, thus making it a business proposition to standardize down to the legal minimum of the class of cheese being made.

By ministerial decree in 1918 Government marks for this class of cheese were issued for cheese containing 40+, 30+, and 20+ per cent. fat in water-free substances. Cheese containing less than 20 per cent. of fat does not carry a Government mark and must be more than 32 lb. in weight. For full-cream cheese a circular mark, printed in blue, is used, and for part-skimmed a hexagonal mark, printed in black. In each case 2 per cent. of fat in excess of that shown by the mark is required, and there are now three control stations, in addition to the two established by the farm cheesemakers which deal with full-cream cheese only.

As with the Gouda variety, the Edam cheese was originally made on the farms, but might be either full-cream or part-skimmed. The practice was to set the night's milk in the cheese-vats and hand-skim it next morning before mixing the warm morning's milk with it. Since separators became available the factory practice has been to skim some of the milk, and very little full-cream Edam cheese is now made. It is claimed that the quality of the cheese made in this way is not as good as when the milk was hand-skimmed, though factory practice is to make it twice daily.

The fat content of the Edam cheese is controlled, and either variety cannot be marked full-cream even when made from whole milk if the fat-content in the water-free substances is not equal to the standard.

Only cheese bearing the Government mark may be exported, and of the total make of 126,000 metric tons in 1927 only 5 per cent. was outside of the control.

During the year ended 31st March, 1934, cultures sufficient to inoculate 91,080 lb. of lucerne-seed were forwarded from the Plant Research Station to farmers throughout the Dominion, an increase of more than 21,000 lb. over last season.

APHIDES AFFECTING CULTIVATED PLANTS.

(1) THE CARROT, PARSNIP, AND WILLOW APHID.

W. COTTIER, Entomology Section, Plant Research Station, Palmerston North.

THE aphid, *Cavariella aegopodii*, at certain times of the season causes serious damage to carrots and parsnips and less obvious damage to willows (*Salix* spp.).

In January or February it will be noticed frequently that carrot-tops become wilted and tend to lie prone on the ground, and if an examination be made it will often be found that the cause of this is the action of aphides or plant-lice which are present in innumerable thousands on the leaves where their white cast skins can be seen littering the foliage. In cases of severe attack an offensive smell is commonly given off, and the vegetable-tops will be sticky with "honeydew" exuded by the insects. Parsnips are attacked in the same way, the aphides living mostly on the undersides of the leaves.

Aphides derive their food by piercing the plant tissues with their mouth parts and subsequently sucking up the sap, so that it can be understood easily why the presence of a large number of them causes wilting.

APPEARANCE OF THE PEST.

There are two adult forms commonly met with in the field—viz., the winged and wingless females. The appearance of the winged form is as follows: The head and antennæ are black; the eyes are black and the thorax very dusky green; the thorax bears two pairs of wings, the front pair being large and the other comparatively small; the abdomen is green traversed by dusky bands, and there are also dark patches on the sides of the abdomen. This winged female serves as the principal means of distribution of the pest.

The wingless form has the head yellowish-green with the eyes black or very dark red; the antennæ are lighter in colour than is the head; the body is yellowish-green, often with a darker green mottling. This form presents a somewhat flattened appearance as if it were closely appressed to the leaf.

The young are similar in appearance to the wingless female.

DISTRIBUTION AND HOSTS.

This insect is not a native of New Zealand, but has been introduced accidentally. It is recorded also from other parts of the world—*e.g.*, England and Egypt.

The host plants known so far in New Zealand, are carrot, parsnip, willows of various types, and the native *Aciphylla* sp. Hosts besides these in other parts of the world are *Aegopodium podagraria* (gout weed) and *Foeniculum vulgare* (fennel).

LIFE HISTORY.

The life-cycle of this aphid is interesting and instructive from the point of view of control. In the autumn there are developed in the aphid-colonies on carrot and parsnip special winged forms which

fly to adjacent willows. On the willows there are produced from these individuals wingless egg-laying females. Winged males appear at the same time and mate with the egg-laying females, which subsequently lay their eggs in the axils of the buds. The eggs are shining black, and there may be several in each bud axil on an infested willow twig. Such is Nature's method of ensuring the survival of the species during the cold weather and until suitable food is again available in the spring. The eggs remain dormant throughout the winter, and in the following spring they hatch at the same time as the willow buds burst, so that a succulent food-supply is right at hand. After feeding and breeding on the willow foliage for a period the colonies produce winged forms which migrate to such plants as carrots, parsnips, and *Aciphylla*. The writer has found this migration going on in November, but it is not usually until after Christmas that the insects have bred to sufficient numbers to cause serious damage. On the carrots, &c., the aphides produce living young and pass through several generations until the autumn when the winged "return migrants," as they are called, return to the willows to recommence the cycle. It is interesting to note that egg-laying females and the males are produced in the autumn only, and that all other reproduction is asexual—*i.e.*, the females give birth to living young without fertilization by the males.

CONTROL

In this connection it is important to remember that the presence of infested willows will always be liable to cause trouble in the carrot crop. Of course, the best method of prevention is to avoid growing such crops in the vicinity of these willows, or, if this is impossible, then grow carrots as far away as possible from the source of infestation.

If the area is not too large, infested plants may be sprayed with black leaf 40, 1 part to 800 parts of water, with the addition of soap at the rate of from 2 lb. to 3 lb per 100 gallons of spray.

ESTIMATED AREAS UNDER WHEAT, OATS, BARLEY, AND POTATOES, SEASON 1934-35.

FOLLOWING the usual practice, cards were recently posted to grain-growers and to potato-growers throughout the Dominion for the purpose of ascertaining the areas which they had sown or planted, or intended to sow or plant, in wheat, oats, barley, and potatoes this season. Estimates have now been made, based on the replies received. The figures appear below, and results in connection with the 1933-34 collection of statistics are shown for purposes of comparison.

——	Wheat.	Oats.	Barley.	Potatoes.
Areas, 1934-35 (estimated) :—	Acres.	Acres.	Acres.	Acres.
North Island	7,000	23,900	2,800	5,100
South Island	221,600	288,900	19,800	15,200
Dominion	228,600	312,800	22,600	20,300
Areas, Dominion, 1933-34 ..	294,992	364,729	29,607	25,028

—*Abstract of Statistics.*

SOME NOTES ON PLANT DISEASES.

MADE DURING A VISIT TO GREAT BRITAIN AND EUROPE.

J. C. NEILL, Field Mycologist, Mycological Laboratory, Plant Research Station, Palmerston North.

DRY-ROT OF SWEDES.

THIS disease appears to be present wherever swedes are grown whether for fodder or seed. Because of my late arrival in Great Britain, and of the partial failure of the crops owing to the drought, I was able to inspect only nine crops of seeding swedes. Of these, seven were definitely infected and the other two were in a condition that made thorough examination impossible.

Of fodder crops, I inspected in October nine crops in Northern England and sixteen crops in Scotland, and in every case the disease was present. Generally it was confined to a few isolated patches, but in three crops it was well distributed, one showing from 80 per cent. to 90 per cent. of infected bulbs. This latter crop had been surface-manured with fresh byre dung after sowing.

No direct measures are taken to combat the disease, but a good practical measure of control is obtained through the long rotation cropping system. At least four years elapse between two swede crops on any field, the bulbs in most districts being pulled, carted, and fed to housed stock. This cropping land is seldom used at any stage of the rotation for grazing. Thus there is little opportunity for fragments of partially rotted bulbs to carry over the disease, the only infections arising directly from infected seed. Since modern bulk commercial swede-seed seldom contains more than a very few infected individual seeds, and since spread from such a "primary" centre is slow and delayed until late in the season, little loss of crop results.

With seeding swedes the congested condition of the seedling bed conduces to early spread of infection, and, since this is a specialist business on small or moderate sized holdings, the crop interval is apt to be curtailed.

Since the visit of the Mycologist to the United Kingdom in 1929, the principal seedsmen have become fully alive to the necessity of reducing infection to a minimum in seed destined for the New Zealand market.

MOTTLED-HEART OF SWEDES.

A disease of swedes very similar to if not identical with that known as "mottled-heart" in New Zealand appears to be increasing in incidence in Great Britain. In Scotland it is particularly prevalent on the west coast, being known in Ayrshire as "Roan." Little attention has as yet been paid to the disease in fodder crops, but growers of table swedes are becoming alarmed at its increasing prevalence, since it seriously reduces the market value of their produce.

Inquiries in Holland, Germany, and Denmark showed that the disease is common in all three countries, but opinions varied as to whether its incidence was increasing. In Canada what is apparently the same condition, there known as "brown-heart," had, on the evidence of Dr. Gussow, Dominion Botanist, seriously threatened the

Canadian export of table swedes to the United States. Experiments there showed that 80 per cent. control could be obtained by the addition of boron compounds to the soil.

Club-root.

Only two of the twenty-five crops of swedes visited showed the presence of club-root, and in neither was the infection severe. The long rotation, absence of grazing-stock, and liberal treatment of the land probably accounts for this. In the opinion of farmers the disease is one of market and kitchen gardens rather than of farms. Liberal liming, good farming, and a long rotation are regarded as the best means of control. Resistant varieties are little used: the "Bruce" yellow Aberdeen turnip, though the subject of much propaganda and widely tried, has not met with favour in the districts visited.

The rapidly increasing use of marrow-stemmed kale (chou-moellier) as a substitute for swedes and turnips is attributed in part to its power of resistance to club-root and dry-rot.

Diseases of Cereals.

Wheat.—Little or no disease was seen in the few wheat crops inspected. On the evidence of seed-testing stations and merchants, it appears that stinking-smut is still fairly common, especially in England, where modern methods of dust treatment for the seed are only very slowly being adopted. Research workers are becoming more interested in the soil-borne disease classed generally under the head of "foot-rots." Apart from the obvious losses these cause in seedling mortality, it is believed that attacks causing a partial crippling of the root system, not detectable on casual inspection, may have a considerable effect in lowering the general yield. Work on this difficult group of diseases has so far been directed to finding a suitable experimental technique as a preliminary to the evolution of methods of control.

Oats.—The use of organic mercury dusts for the treatment of seed-oats has become a generally adopted practice, especially in Scotland and Northern Ireland. This has followed on the remarkable results obtained in 1931 and 1932 in the control of leaf-stripe disease and consequent large increases in yields. The dry spring weather of 1933 and 1934 was unfavourable to development of the disease, and consequently the dust treatments showed only slight advantages when compared with seed not so treated. Nevertheless, all farmers visited were of the opinion that the organic-dust treatment is a valuable practical improvement on the older methods because of its simplicity of application, the insurance it affords against possible heavy losses caused by disease, and the reduced rate of sowing made possible by its use.

Barley.—As with oats, the noteworthy advance in method for disease control in barley is the increasing use of organic mercury dust seed-treatment. It is found that, besides controlling covered smut, these dusts are effective against stripe disease and minimize seedling mortality when unfavourable weather follows sowing.

DISEASES OF POTATOES.

Late Blight.—Little progress has been made in the evolution of new methods for the control of this disease. Bordeaux and Burgundy mixtures are still regarded as the best spray control, and no commercially valuable variety has yet been discovered which is immune to the disease.

Virus Diseases.—The degeneration troubles and crop losses due to this group of diseases are the subject of much research work in the United Kingdom, Holland, Germany, and Denmark. In Holland only has practical application of existing knowledge resulted in their virtual elimination, the Dutch growers having been forced into stringent co-operative measures by the great importance of their export trade in seed potatoes.

It appears probable that the economic control of the potato industry established recently in Great Britain will be extended to cover measures similar to those in force in Holland.

Wart Disease.—Particular attention was paid to this disease in view of the possibility of its introduction into the Dominion and the fact that our main commercial varieties are classed as highly susceptible to the disease. In general, it appears that wart disease is a trouble of the kitchen garden rather than of the field, and that only exceptionally does it cause serious loss of crop even in infected soil. So much importance is, however, placed upon its occurrence that movement of potatoes is severely restricted from areas in the neighbourhood of a reported occurrence. In one case in Fifeshire a malicious farm servant deliberately introduced the disease into his cottage garden and then reported its occurrence to the authorities. As a consequence, no seed potatoes were allowed export from land within an area two miles in radius from the cottage, comprising some of the best seed-producing farms in Scotland, thus causing the farmers a loss of many thousands of pounds.

Instant measures should, of course, be taken to stamp out any discovered outbreak of the disease in the Dominion, but, even if these fail, it should not be regarded as a major calamity.

GENERAL.

Other diseases which are receiving particular attention in Great Britain are the virus and root diseases of strawberries and raspberries, virus diseases of tomato, damping-off diseases of seedlings, and turf diseases of playing-greens. An interesting fact, communicated to me by Mrs. N. L. Alcock, of Edinburgh, is the discovery of *Sclerotinia trifoliorum* sclerotia on the seed of British-grown white clover—heretofore regarded as only occurring in New Zealand and hence as conclusive evidence when present of the origin of any sample of white-clover seed. Very fine work is being done at the Forest Products Research Laboratory at Princes Risborough on the fungous rots and stains of timbers and methods for their control.

A striking modern development in plant pathology is the attention being paid by the large chemical manufacturers to research work in disease control. Several of them, notably the Imperial Chemical Industries in England and the I. G. (Bayer) corporation in Germany, employ large staffs, admirably equipped, of trained mycologists and entomologists for the sole purpose of determining whether any of the new compounds evolved by their chemical research departments has value for disease or pest control. It is likely that new materials and methods will, in the future, originate largely from this source.

ERADICATION OF GORSE AND THE UTILIZATION OF GORSE-INFESTED LANDS.

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ON mountain pastures of the northern counties of England, gorse (*Ulex europeus*) is not unfavourably regarded, and as sheep continuously graze these pastures, gorse provides a considerable amount of sheep food, is looked upon as an almost indispensable plant, and under the system of continuous grazing does not become a menace, as in many parts of this country.

Gorse was brought to New Zealand by the early settlers not for the purpose of providing fodder, but to grow as hedges for subdivision of land and also for the shelter on the then wind-swept plains of Canterbury. From there, through human and animal agency, it has spread to almost all parts of New Zealand, and also to adjacent and outlying islands. It is not confined to inferior lands or any particular habitat, but, owing to our congenial climate being favourable for the propagation of plant-life, gorse is rapidly encroaching on valuable pasture and arable lands, and to-day we are not interested about its erstwhile valuable properties, but confronted with the problem of its control, if not of its ultimate extermination.

ERADICATION ON ARABLE LAND.

There is no valid reason for allowing gorse to occupy arable land, from which its eradication is easily and economically effected by the aid of mechanical appliances, prominent amongst which is the plough. The effectiveness of this implement depends on the vigour of the plants and the stage of growth attained.

Presuming that gorse is dominant, the area which it is desired to clear may be fired, preferably during late summer. The seat of ignition should be to leeward ; this allows the fire to travel " up wind," or, in general phrase, " against the wind," thus effectively clearing all vegetation, leaving only charred branches which, if not too big to plough under, need no further attention. In the event, however, of the plants being vigorous and of considerable age prior to burning the area will require cleaning up before the plough can be operated. A tractor and heavy roller will break down the burnt branches, and, furthermore, smash the charred material to such an extent that most of it can be ploughed under, leaving only the rough and thicker sticks to be gathered and carted off the land prior to ploughing.

Accelerated by fire and autumn rains, the accumulated seed of many crops rapidly germinates, so that when the plough is brought into play the product of a succession of years is buried and for all time destroyed.

There remain, however, millions of seeds which escape the fire. These will germinate from time to time as they are brought to the surface in the process of cultivation, but need not cause any concern ; the same process that stimulated germination will hasten extirpation.

SUBSEQUENT UTILIZATION OF THE LAND.

A variety of crops may follow, and whatever seed is planted immediately the manurial requirements are already partly and liberally

provided by the nitrogen fixation of the growing gorse and the residual ash of the burnt plant; consequently, phosphates only need be applied. If the soil is adapted to wheatgrowing no more suitable crop can be grown. Any gorse that grows with the wheat does not affect the cereal or incommode reaping operations, and, as the stubbles are afterwards grazed over by sheep, the young gorse provides useful and nutritious forage; at the same time the grazed plant receives a set-back and is killed when the land is next ploughed.

Rape or any other plant of forage can be successfully grown on the first or successive ploughing, and after a course of cropping the land can be laid down safely in grass, and, if given reasonable attention with regard to mowing, grazing, and manuring, the erstwhile gorse-infested land will for all time remain clean.

Control where Ploughing is Impossible.

It is on those areas where mechanical aid cannot be brought into operation that we are confronted with the greater problems of eradication and subsequent economical upkeep and utilization of gorse-lands.

In considering these, it is advisable to divide the lands into two types—(1) That which can be maintained as useful and payable pasture; (2) poor hills and gullies.

From time to time proprietary preparations have been on the market, and many statements have been circulated extolling the effectiveness and most remarkable achievements of the various preparations. No chemical treatment of gorse which has been shown to be economically effective has so far come before the public.

On hill lands which can be classified as potentially useful grassland it is essential first to cut the gorse; on no account should growing gorse be burnt on this type of land. Such burning leads to millions of seeds germinating immediately after the ashes cool, and the result is a dense mass of young gorse which can neither be cut nor burned again. Cutting should be done during late spring or early summer, and the heavier the gorse the more effective will be the clearance. When cutting is completed no further action is necessary until March, when, weather conditions being suitable, the gorse should be burnt; and, as previously mentioned, it is advisable to ignite the mass so that the fire travels against the wind. By so doing the fire does not pass too rapidly over the area, and, consequently, burning is accomplished more effectively. Frequently it is said that cutting may be done at any time of year and the result will be the same, but this is incorrect. If gorse is cut during the winter or late autumn, the interval between cutting and burning is too long, consequently the spines fall from the branches, burning is not effective, and growth starts immediately from the original stumps.

SOWING THE BURN.

No time should elapse between burning and sowing grass-seed—and, in connection with the latter operation, let me say that seeding and manuring should be liberal in order to establish quickly a good sole of grass which can be stocked early, that is, within a reasonable time after sowing the seed.

Varieties of grass sown will, of course, be determined to some extent by the class of soil. However, in all cases it is desirable to include in the mixture *Danthonia pilosa*, brown-top, subterrannean clover, and, wherever climatic conditions are suitable, paspalum should be included.

It may be asked why are these plants specifically mentioned. However thorough cutting and burning and seeding be, and no matter how carefully managed with regard to stocking the resultant pasture, gorse persists, and, in the event of a thick crop of gorse seedlings growing and being neglected by stock, it may become advisable to close the area, allow the herbage to ripen, and again burn off; and the pasture plants specified tolerate such burning-off relatively well.

SUBDIVISION OF AREAS.

While it may not be possible always to fence gorse lands economically, there is no doubt that subdividing large areas facilitates subsequent management and control of herbage. Gorse cannot thrive when heavily stocked, and heavy stocking can be carried on only where fences are strong and paddocks of reasonable area.

GULLIES AND STEEP HILLS.

In many instances gorse is in full possession of gullies and steep hillsides, and, while portions of these are of no value, there is a very large area which might be utilized profitably in growing trees for timber. Pines and eucalypts in such situations ultimately "choke" gorse, and, if the trees are safeguarded against destruction by fire, gorse-infested gullies and hillsides will in several decades become valuable forest lands.

THE LLOYD GEORGE RASPBERRY.

THE Orchard Instructor, Gisborne, has supplied the following note:—

The Lloyd George variety of raspberry appears to have excellent prospects of proving successful when grown in the warmer districts in New Zealand, where few, if any, other varieties succeed In the winter of 1932 small canes were planted at Gisborne in moderately moist, porous loam alongside of other raspberry bushes which were originally secured from a commercial garden in Greytown (variety unknown). During the 1932–33 season the Lloyd George variety made extremely vigorous growth and produced several good sprays of fruit In the following season the bushes carried a heavy crop, whereas the bushes of the Greytown variety carried a very light crop and made poor growth. The fruit of the Lloyd George variety was very large, of good flavour, and commenced to ripen in mid-November. Some of the heaviest pickings were made about the end of November. The crop continued until about the end of January. The fruit of the other variety did not commence to ripen until 24th December. The growth of the Lloyd George is inclined to be straggly, but the canes remain reasonably erect to a height of about 2 ft. 6 in, thus enabling the rambling portion to be removed during the winter pruning without sacrificing good canes. The following quotations from recent overseas publications are interesting:—

Advisory Leaflet No. 180, "The Cultivation of Raspberries," Ministry of Agriculture and Fisheries, London, May, 1933. In this publication Lloyd George is mentioned first of what are reported to be the four leading commercial varieties, and it is stated:—

"Lloyd George is one of the most extensively grown and heavy croppers; the berries are easily plugged, are firm, and travel well. It is one of the best varieties for canning. The picking season extends over a long period; the first ripening berries are ready to be gathered as early as those of any other, and earlier than most varieties. In some districts a loss of vigour occurs after the fourth year; where this prevails it is advisable to select canes from the most vigorous plants and make a new plantation"

Bulletin No. 625, "Raspberry Growing in New York State," New York State Agriculture Experimental Station, Geneva, New York, April, 1933. In this publication it is stated,—

"Lloyd George is too soft, turns dark, and is of low growth and sprawling habit under most conditions, although its fruit is very large, handsome, and of excellent quality for the table and for jam."

SEED-WHEAT CERTIFICATION.

CERTIFIED CROPS.

UNDER the Government scheme for the certification of seed wheat, the following additional growers have seed for sale from crops which have passed both field and grain inspections. (Previous lists, to which purchasers are referred, were published in this *Journal* in February and March, 1935) :—

Variety.	Grower	Acreage.
Cross 7	*Canterbury Seed Co., Leeston..	6
Dreadnought 5/27	*R. Dick, Weston, via Oamaru	25
	*G. Stevenson, Weston, via Oamaru	14
Hunter's II ..	J. G. Abbot, Coutt's Island, Kaiapoi	7
	W. H. King, Rosewill, Timaru	30
	*Mrs. E. G. Paterson, Otaio, South Canterbury ..	50
	F. L. D. Young, "Brockfields," Winchester ..	7
	D. J. Ireland, Goodwood, Otago	18
Solid Straw Tuscan	Canterbury Seed Co., Leeston	29
	*N. Cox, 230 Wairarapa Road, Christchurch ..	5
	*H. Curragh, Weedons	7
	D. Findlay, Christchurch–Greendale, R.M.D ..	23
	H. W. J. Goodwin, Wincopes Road, Halswell ..	11
	Estate C. Smith, R.M.D., Rangiora–Springbank..	30
	Mrs. F. Woffindin, Pleasant Point, via Timaru ..	8
	G. Newlands, Kauru Hill	30
	W. S. Stevenson, Incholme, R.M.D., Oamaru ..	22

* Passed subject to machine dressing.

—*Fields Division.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 7th March to 21st March, 1935, include the following of agricultural interest :—

No. 71714 : Solution of ingredients toxic to weeds ; E. Marsden. No. 72266 : Apparatus for spraying weed-killing solution ; E. Hope. No. 72538 : Stock-drenching instrument ; Ject-in Ltd. No. 73038 : Sodium chlorate (*Cognate with* No. 71714 above). No. 71599 : Hay-stacker ; W. Alexander. No. 71621 : Hopple-protector ; W. Patching. No. 73328 : Drenching-gun ; D R. Dowling. No. 73413 : Preserving fruit ; A. Gerner-Rasmussen. No. 73424 : Milk-supporting platform ; T. Shiels.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

There has been an alteration in the dates of the Fifth Science Congress, which is to be held at Dunedin, not on 28th May to 31st May, as was stated in this *Journal* in March, but on 27th May to 30th May, inclusive.

Despite the fact that a great deal of clearing has been carried out, ragwort has become so widespread that it might appear that no real headway has been made in its eradication or proper control. It must be borne in mind, however, that approximately 500 tons of sodium chlorate went into consumption during the season, and this, with other methods of destruction, must account for no small measure of success in clearing. Many individual farms have been cleared and kept clear of ragwort, but, on the other hand, there are many that are probably worse than they were a year ago. Special efforts have been made to keep the already clean districts clear of ragwort.—*Report, Director of Live-stock Division.*

SEASONAL NOTES.

THE FARM.

Influence of Management and its relation to Planning.

THE extent to which management affects profits in farming seems but imperfectly to be realized. Hence some consideration of the matter may direct attention usefully to the scope for improvement in farm efficiency and returns. Examination of the position on farms which naturally are similar, but which human endeavour has made very different farms financially, discloses generally that inefficient management is due to waste in respect to either outlay or labour.

Farm surveys provide striking evidence that there is a great difference in the efficiency of farm labour, for instance, a recent survey disclosed that under relatively uniform conditions of soil and climate the production of butterfat per unit of male adult labour, unaided by subsidiary family labour, ranged from 3,338 lb. to 10,480 lb. While the butterfat-production per unit of labour is far from a full measure of the absolute efficiency of management, such a range as specified above is surely significant. Efficiency in farm labour is correlated closely with planning ahead by an experienced mind so that there is proper organization of effort. Farming-work, to be fully successful, must be planned so that there is provision not only for carrying out every detail of an operation, but also for carrying it out at exactly the proper season. Time and again very disappointing results in important farm measures may be attributed to neglect in respect to only one of the chain of facts which beget full success. For instance, considerable wise outlay and effort in respect to the establishment of permanent pastures is at times wasted because of sowing at an unsuitable date, and again much labour in cropping may be made largely ineffective by too late attention to such operations as weeding, thinning, or spraying.

These illustrations exemplify well the fact that waste of labour may be due not so much to idle hours as to lack of a well-planned programme of work, and help to explain those cases, known to most of us, of farmers who work hard for long hours without ever achieving satisfactory success. The remedy in such cases is additional mental labour to make the physical labour properly effective Apart from the indirect waste of labour due to doing work at unsuitable times, or with poor material or equipment, there often occurs direct waste of labour due also usually to lack of proper planning ahead so as to avoid idle hours especially in the case of paid hands. It is advisable to have other work available as soon as one task is completed or when bad weather necessitates cessation of certain work. Labour is likely to be wasted, and this possibly when the time factor is particularly important, as in such tasks as seed-sowing, hay-making, and other harvesting, if advantage is not taken of slack seasons to attend to such matters as drainage and repairing of implements. Probably not enough attention is given to the avoidance of peaks in labour-requirements by planning ahead so as to obtain the greatest possible distribution of work; sharp rises and falls in the amount of work calling for current attention are commonly associated with hurried effort lacking care and thoroughness, or with unduly heavy casual labour costs on the one hand or with idle hours of permanent labour on the other hand. On many farms some planning would avoid considerable wastage of time in running about.

Many of these aspects of labour utilization may seem so self-evident as to be not worth mentioning, but in practice they are ignored frequently, and this partly explains the great variations in the productivity of labour.

Poor management in regard to outlay takes several forms. One of the most serious of these may be described as parsimony or false economy in the guise of economy. One of the commonest instances of this is the purchase, because of the relative low cost, of seeds poor in respect to either their germination capacity or the inherited characteristics of the resultant crops.

A kindred instance is the lack of suitable equipment or the use of poor equipment which prevents the full exploitation of the labour available. This is one of the greatest causes of inadequate provision of feed for stock during the critical late summer and winter-early-spring periods. It is certain, for instance, that the area devoted to ensilage would be substantially greater were labour-saving measures, including important yet inexpensive ones, more freely employed. Similarly, many farmers are handicapped in the production of special crops by lack of implements. Certainly it is advisable to be cautious in rectifying such positions because of the possibility, as distinct from the probability, of hampering other phases of the farm work by unduly heavy investment in equipment, but it may be said definitely that excessive caution in this direction has been exercised in the past.

Another very common form of mismanagement in respect to outlay arises indirectly from wasteful utilization of feed, whether it be purchased or grown on the farm. This occurs seriously at times when the feed which productive farm animals receive is much less than is needed to meet their joint maintenance and production requirements. This may be illustrated readily by considering the requirements of a good dairy cow of about 1,000 lb. weight. Annually such a cow requires about 10 tons of grass or its equivalent for maintenance and about 1 ton of grass or its equivalent in addition for each 30 lb. of butterfat produced. A consumption of 15 tons of grass annually gives enough nutriment, after maintenance requirements are satisfied, to allow of the production of 150 lb. of butterfat—*i.e.*, 10 lb. of butterfat for each ton of grass. Similarly, a consumption of 23 tons of grass allows of the production of 390 lb. of butterfat—*i.e.*, 17 lb. of butterfat for each ton of grass or its equivalent. The differences in the productivity of feed according to differences in its utilization, as disclosed in this comparison, may seem somewhat extreme, but they appear at times to be paralleled in practice. The position may be stated in concrete form as follows: Using cows of good productive capacity, 345 tons of grass or its equivalent could be fed at the rate of 15 tons annually to each of twenty-three cows, which from such a feed-supply could produce a total of 3,450 lb. of butterfat, or it could be fed at the rate of 23 tons to each of 15 cows which could produce 5,850 lb. of butterfat. The difference in production is due primarily to the fact that in the former system of feeding 80 tons more than in the latter are used solely for maintenances and thereby are "wasted" relative to butterfat-production. Commonly in other branches of farming, among which pig-keeping and lamb-rearing may well be cited, feed is similarly wasted in that an unduly small proportion of it is available for production, because, conversely, an unduly heavy proportion is required for maintenance. Much the greatest and an easily corrected cause of an unsatisfactory relation between feed required for maintenance and feed required for production is failure to plan ahead the provision of feed to meet the requirements of stock from one season to another. Incidentally it is of practical importance to keep in mind that at times the efficiency of management cannot be measured in terms of feed units consumed. For instance, rapid feeding from birth to slaughter as a rule is more economical in feed units consumed than feeding which involves a period of slow growth or of store condition in animals. As an example of this the late Professor Wood, of Cambridge University, calculated that 10 cwt. of baby beef could be produced from a consumption of 830 lb. of dry matter for every hundredweight of baby

beef, whereas, in the production of 12 cwt. of beef in the form of a 2½-year-old bullock, 1,220 lb. of dry matter would be required for each hundredweight of beef. It cannot be decided from such figures whether or not the more intensive type of feeding is the more economical until the cost of the dry matter required in each type is known. In New Zealand the cost of dry matter in grass, roots, and dairy by-products is usually much less than that of dry matter in meals and grains, and this at times justifies departures from the feeding practice which, while most economical in terms of feed units, is not most economical under present circumstances in terms of costs. As a current instance of this, pigs for slaughter early in the following dairy season as baconers profitably have been carried through the winter largely on cheap feed, such as roots and grass, and then finished off cheaply with concentrates available at a suitable stage in the diluted form of dairy by-products. It is likely that at times during the winter the weights of the animals did not reflect satisfactorily the feed being consumed, but nevertheless the practice as a whole proved sound financially.

From the above considerations it would appear that a keynote of sound management is planning ahead as a means of avoiding waste, direct and indirect, in respect to both labour and material.

Planning of Feed Provision.

It is seasonable to plan the coming year's programme of special feed provisions—possibly later it may prove advisable to make modifications in respect to minor matters, but it should be possible to adhere to the main features of any plan which in the meantime is likely to serve usefully as the basis of decisions about such jobs as cultivation work and the location of fences and of ensilage pits and trenches, to which attention often well may be devoted in the winter

Usefully, in general, the planning of the provision of special feed could be based upon the fact that normally the supplementary feed available for periods of scant direct supplies from grassland could be increased substantially with great profit. Behind the planning, and especially when there is much dependence upon ensilage, should be the aim to create not merely seasonal reserves, but also annual reserves of feed; there is no certainty at all that during next summer the pastures will yield enough surplus growth to give reasonably safe supplies of silage and hay, and safety in regard to supplies of the cheapest possible feed is a maxim of efficient stabilized farming. Hence, if in the recent unfavourable season reserves of feed were depleted to an unusual extent, then cropping to strengthen the position suitably should be planned. It is of seasonal interest that the mangel (the Dominion acreage of which is much less than is warranted by the outstanding value of the crop) often gives the largest and most profitable yields when grown after grass ploughed in May or June. Such ploughing allows enough time for the thorough decay of the buried sod and results in a richer, more kindly soil due partly to the incorporation of the rotted sod with the remainder of the soil. As an alternative to ploughing at this stage, skim ploughing or disking of the sod in the spring, followed by deep ploughing, may be expected to give good results. Similar preparatory cultivation for lucerne, carrots, and potatoes, when these crops are to follow pasture, is, as a rule, profitable. In the preparation for these crops heed should be given to the fact that a buried sod, if not broken up, means not only a soil less rich in plant-food material, but one in danger of drying out in a dry spell because the unbroken sod checks the rise of soil-water from below it: this is likely to be of vital importance in the drier districts in which the supply of moisture often is the factor which most limits yields.

A common weakness in the provision of special feed is the giving of attention only to the stock of major importance on the farm and the neglect

of the needs of types of stock which, though of less, are nevertheless of considerable, importance, and which would respond very profitably to proper feeding. For instance, on mixed farms in the South Island the needs of dairy stock seem often to be forgotten, and similarly on dairy-farms throughout the Dominion the potential profit in feeding special crops properly to pigs frequently is overlooked.

On the mixed farms in the South Island much could be achieved in profitably meeting the needs of dairy stock, simply by extending the arable cropping undertaken for the feeding of sheep. In pig-rearing good results have been obtained, according to circumstances, from the use of pastures and lucerne for grazing, and of barley, maize, peas, pumpkins, chou moellier, and all the main farm roots according to seasonal requirements. Limited experience suggests satisfactory results from the emergency use by pigs of green cereals for grazing, but in this the relation between costs and returns calls for close consideration.

General Cropping.

The remarks in last month's notes relative to general cropping work are applicable widely to current operations. In districts in which arable cropping is prominent, no opportunity should be missed at this stage of proceeding with cultivation work, and sometimes it is of assistance to act upon the fact that lea land may at times be worked with safety when adjoining similar land which has been under the plough recently is too wet.

Autumn Utilization of Crops.

Often lucerne suffers much as a result of being grazed in late autumn and early winter, a practice which should be avoided as a rule, even though there is a growth of a few inches in height on a lucerne area at this stage. Actually, such a growth is far from wasted even if it is not consumed by stock: it often checks development of weed seedlings by depriving them of light, whereas if it were removed the lucerne stand usually would be weakened to some extent because some of its energy would be employed in renewing the herbage. Such weakening often is specially undesirable as the maximum strength is needed for success in the spring competition with weeds. Should a lucerne area already be infested badly with grass and clover, it may be good practice to utilize it chiefly as a pasture from which it may be possible to obtain as many as three cuts a year.

Because of the unfavourable past season in many parts, the coming winter and spring probably will be characterized by hard treatment of many stock, and on this account it is well to note that young developing stock, such as calves and hoggets, are likely to suffer severely and also permanently unless they receive good treatment. This fact calls for attention not only during winter itself, but also prior to winter, when the stock should be trained to eat such feeds as silage and hay, while they are still in good condition, and before they are called upon to live almost wholly on such unfamiliar feeds, a timely gradual introduction to which obviates the setback at times suffered by live-stock as a result of sudden changes in feed. Hoggets should be given the best possible treatment, such as access to suitable forage crops and a run-off from these on fresh clean short pasture.

Care of Pastures.

Top-dressing and harrowing as discussed in these notes in recent months may still call for attention.

At this season newly established pastures require careful treatment, the essential feature of which is the avoidance of the extremes of undergrazing and of overgrazing. To keep the young growth appropriately short, as a rule it is advisable to graze with a relatively large number of stock for a short time—this tends to obviate the severe selective browsing of the more attractive species which at times occurs under light stocking

with injury to the overgrazed species when such treatment is prolonged. Undergrazing is especially likely to be harmful when temporary species, such as Italian rye-grass, are prominent in the pasture ; temporary species, if not checked, tend to outgrow and consequently to injure the slower permanent species by shading. When the soil is soft because of rain special care should be taken with young pastures to avoid "poaching," which facilitates the ingress of weeds.

Liming.

In last month's notes it was pointed out that field investigations do not always provide evidence that would justify recommending the use of lime, but, when it is considered that liming is advisable, it may be carried out suitably in April or May. If separate dressings of lime and an artificial fertilizer, such as superphosphate, are to be applied within a short interval, it is considered preferable to apply the lime before the fertilizer, as this allows time for the lime to become incorporated with the soil, which is believed to obviate certain undesirable chemical changes that at times may occur when fertilizer is applied in the absence of lime If desired, as a labour-saving practice, superphosphate and ground limestone (carbonate) may be mixed and applied as one dressing, but, as a rule, superphosphate and burnt lime should not be mixed on farms unless it is known that the mixture will be applied immediately.

Normally, lime readily makes its way downwards in the soil, and, especially in districts of good rainfall, tends to be washed away and lost to crops. Hence, in general, the working of lime into the soil is not only unnecessary, but also disadvantageous in that it hastens the loss.

In general, in the case of materials of a satisfactorily high degree of purity, approximately 2 tons of ground limestone are equivalent in their ultimate effect on the soil to 1 ton of burnt lime. This fact, which should be the basis of comparison of the cost of these two forms of lime, is also of considerable importance when the cost of the carriage of lime becomes heavy If land is not especially in need of lime, then heavy cost of carriage may readily make the advisability of liming very doubtful. Probably the matters of greatest current moment relative to liming are (1) the continued tendency to substitute lime wholly or partly for phosphates on farms about which there is no evidence that this practice, which is adopted merely as a means of reducing outlay, is sound, and (2) the failure to use lime adequately on those farms which would respond profitably to free use of limes. Farmers who have not definite knowledge of the effect of lime in their district may obtain all the available knowledge from local officers of the Fields Division.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Autumn Spraying of Stone-fruit Trees.

To secure a satisfactory control of leaf-curl on varieties particularly susceptible to attack by this disease, it is necessary that two applications of a fungicide at winter strength should be made. Better control of other fungous diseases can also be secured by two such applications. These sprays can be applied either in the early winter when about 50 per cent. of the leaves have fallen, and repeated in the spring at the bud-movement stage of growth, or alternatively the two sprays can be applied in the spring, the first at early bud-movement and the second from seven to ten days later. Owing to the risk of wet weather interfering with spraying operations in the spring, it is a good practice to make the early winter application. The fungicide recommended for this purpose is Bordeaux mixture at a strength of 5-4-50.

Silver-leaf and Fireblight.

Trees which are affected with silver-leaf and which are to be destroyed should be either removed forthwith or marked in some very conspicuous way, as affected trees are readily overlooked once the foliage has fallen.

In orchards where fireblight was prevalent during the past summer, a minute inspection should be made as early as possible for cankers, preferably before the foliage has fallen. Dead leaves frequently indicate where infection has taken place and lead to the finding of cankers that otherwise might pass unobserved. If this work is left until the trees are being pruned, there may be no dead leaves then remaining and cankers can pass readily without being detected. Where limbs have been removed during the summer on account of fireblight infection, the cuts should be examined closely to ascertain whether the infected part has been removed entirely and whether any further infection has taken place through the wound. It should be borne in mind that one small canker left to over-winter is capable of reinfecting a whole locality with fireblight during the next blossoming period.

Drainage.

Adequate drainage is one of the most essential factors in maintaining healthy trees. The effects of an inadequately drained soil are reflected in the general unhealthy appearance of the trees. Roots of trees will not tolerate indefinitely a saturated soil condition, and as the roots of mature trees penetrate to a considerable depth it is necessary for good drainage to be provided for at least 4 ft. or 5 ft. from the surface. Considerable mortality amongst mature trees is occasioned each year as a result of a condition known as sour-sap. While this trouble sometimes occurs in well-drained soil, it is more often due to inadequate drainage of the sub-soil. The cleaning and deepening, where necessary, of all open drains should be attended to each season before the wet winter conditions set in.

In portions of some orchards it may be necessary to lay further drains. In doing so, points to be considered are—adequate depth, sufficient fall the full length of the drain, and the avoidance of sharp angles In a retentive soil, ready access for the surface water to the drain is imperative ; therefore, if pipes are used, they should be covered with clean rubble or scrub. A retentive soil placed in direct contact with the pipes seals the spaces between each pipe section, and thereby prevents the surface water reaching the drain.

New Plantations.

Where new plantations are contemplated, the provision of adequate shelter belts is of the utmost importance Where possible, such belts should be planted at least one year before the orchard trees. The cultivation of the soil during the previous summer and autumn and the provision of good drainage are also most desirable.

In those localities where such conditions obtain, and the soil is not of a retentive nature, planting can be done during the month of May provided the soil is not in a very dry condition Under less favourable circumstances spring planting is recommended. The order for trees should be placed with a reliable nurseryman as soon as possible. The distance apart for planting must be governed by the nature of the soil, the kind and variety of the tree, &c. Where vigorous growth is to be expected, consideration must be given to the tendency noted in recent years for the encouragement of large trees by variations in methods of pruning. Where such conditions are likely to obtain, many varieties of apple, pear, peach, and nectarine should be planted up to 24 ft. or 26 ft. apart, while under different circumstances a distance apart of about 20 ft. will generally suffice.

On arrival from the nursery the young trees should be immediately unpacked and dipped in a solution of red spraying oil (1–10) as a safeguard

against any insects or insect eggs that may be present on the trees. They can then be heeled in singly in a trench made for the purpose, taking care to cover the roots thoroughly with damp and well-pulverized soil to prevent drying-out.

Pruning.

All fruit-trees (excepting citrus) require systematic pruning each winter if the best results are to be secured. This work should be commenced as soon as possible after most of the foliage has fallen. Stone-fruit trees are ready and should be pruned before pome-fruit trees In localities where mild winter temperatures are experienced the trees should be completely dormant before pruning is commenced, as early-pruned trees are liable to be excited into premature growth.

Further and more detailed advice on pruning will be given in these notes in the next (May) issue of the *Journal.*

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

Those who have established groves and contemplate increasing their area by fresh planting should have their trees ordered from the nurseryman in plenty of time beforehand so that they may get the pick of the trees, for only the best developed trees in the nursery will continue to grow the best when planted out in the orchard, provided that the conditions there are favourable.

In laying out new groves advantage should be taken as much as possible of any natural shelter, and if the soil is not naturally well drained steps should be taken to drain it artificially, for it is useless to attempt to grow citrus trees in soil waterlogged and lacking adequate shelter from cold winds Shelter-belts should be all established several seasons before the trees are planted out so as to ensure a good start.

The condition of the soil plays a very important part in the establishment of a citrus orchard, and so thorough cultivation of the land selected should be undertaken some considerable time before planting. Liming well, and the ploughing-in of a cover crop, especially in land that is at all inclined to be heavy, will assist materially in the breaking-up and sweetening of the soil in subsequent cultivation.

The more time and labour spent in the preparation of the land the better will be the results obtained when the trees are planted out

In selecting trees all indifferently grown and stunted ones should be discarded, as only the best may be expected to give the best results. Spring planting is preferable to autumn, as there is less likelihood of the young trees being checked by frost and more time is given for the land to sweeten, and winter cultivation can be undertaken if necessary.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Colds and Roup.

THIS is a period of the year when colds are often contracted by the birds, and especially pullets which have been hatched at a late date, so that a careful watch should be kept for any birds showing the first symptoms of being affected with this trouble. Such symptoms are sneezing and running at the nostrils, to which dust and dirt adhere, while in severe cases the discharge will be found on the feathers under the wing, owing to the birds sleeping with their heads thereunder. Where any of these symptoms are observed, the first essential step is to find the cause of the trouble and remove it, as with most troubles affecting poultry it is practically futile to try to cure colds if the cause is not found and removed.

Colds are the forerunner of that deadly disease, roup, which is one of the most difficult diseases that the poultry-keeper has to contend with, for if it once gets a good foothold the whole of the flock may become affected in a short space of time Colds are caused most commonly by compelling the birds to sleep in an ill-ventilated or draughty house, while exposure to rain, and damp, over-crowded quarters are often responsible. Special care should be taken that the partitions dividing the house are absolutely airtight, and therefore the intersecting walls should be made of some such material as asbestos slate, beaver-board, &c. If the partition is to have the desired effect, particularly in exposed conditions, it should extend the full width of the house, and not merely a few feet from the back wall. Although plain 1 in. boards are commonly used for partitions, they are unsuitable for the purpose, for the reason that they can seldom be regarded as absolutely draught-proof. Where a neglected cold has developed into the dangerous roup, at which stage the breath becomes offensive, while usually one eye becomes swollen and finally a cheeselike substance protrudes from it, little or nothing can be done for the bird, and usually the best course is to destroy it and burn the carcass.

The Moulting Period.

A common weakness in the system on many poultry plants at the present time is to reduce the ration of the adult stock merely because they are on the point of or are going through the moulting process and therefore not in a laying condition. This short-sighted policy is to be deprecated, for it is not only cruel, but decidedly unprofitable It should be remembered that during moulting the bird's system is taxed to the utmost in producing the new crop of feathers, which must necessarily come from the food she eats. Especially is this the case with the heavy layer that has just finished an exhaustive laying period. If her next season's laying is to be profitable, it is therefore imperative that she be given ample food in order to recoup her strength and resume laying in the shortest time For the moulting bird there is nothing better than the usual diet, making sure, however, that ample green food is provided. Maize may be added to the grain ration, and the morning mash should be made as appetizing as possible by mixing it with boiling water or preferably milk. In addition to receiving liberal feeding, the birds should be well housed, and, above all, they should not be subjected to draughts. It is also necessary to protect them from exposure to cold and wet weather. They should not be compelled to stand in a cold wet yard waiting for feeding-time, as such exposure of a half-naked bird must obviously have an undesirable effect on it. As is the case with birds of all ages at this time of the year, they should be fed in the house, so that they will secure all the food they require without having to go out into the open on cold wet days. If the moulting bird has been considered sufficiently good to retain in the flock for another year, then she certainly deserves to be well treated, even although she is temporarily unproductive. The amount of attention she receives now largely influences the time at which the productive season again commences.

Scaly Leg.

A subscriber is anxious to know the cause of and how to prevent scaly leg on his fowls. Scaly leg is found usually on the legs of fowls improperly managed, and particularly those kept in dirty quarters. It is caused by a minute parasite which breeds under the scales of the unfeathered portion of the bird's legs and the upper part of the toes. The parasite there irritates the tissue by attacking with its strong mouth-parts, and as a result of its activity in this way large scaly masses which appear give the bird a most unsightly appearance. Usually the parasite attacks both legs at the same time. This trouble not only gives the bird a most unsightly appearance, but also affects its general health and its production

as well chiefly because of irritation and loss of rest while roosting. There are many methods of treatment, but one of the most simple and rapidly effective is to apply a mixture formed of equal parts of sulphur and lard, to which has been added sufficient pure kerosene to make the whole into a more or less liquid form. This should be mixed in a fairly wide but shallow tin or similar vessel. When treating a bird a good plan is to kneel down, having the tin containing the mixture right opposite. The head and fore parts of the body are placed between the knees to prevent the bird from struggling. The legs are held in the left hand, the right being used to run the mixture well in with a piece of soft cloth. Care must be taken that it reaches the deepest parts. The treatment should be repeated weekly until a cure is effected.

Scaly leg should never be neglected, as from one affected bird it will soon spread through the flock. A common misconception is that scales on the legs are an indication of advanced age in a bird. Certainly the trouble is rarely seen in very young chickens, but it is quite common in young pullets even before they commence to lay. Many good pullets have been considered old hens and sent to market simply because there was some scale on their legs. Chicks always should be marked in the web of the foot when young, and by keeping a register the age of a bird can at once be ascertained With scaly leg, as with the bulk of troubles that affect poultry, the only sure remedy is prevention, the essential factor of which is cleanliness

Leg Weakness in Growing Cockerels.

This is one of the many troubles affecting poultry in which prevention is the only satisfactory course The invariable cause is insufficient exercise and a too liberal supply of over-forcing foods In the case where cockerels are intended for breeding purposes, forcing food and confined quarters at this stage are a mistake Too often after the most desirable cockerels are selected for breeding purposes, they are placed in a small coop or run without any of the requirements which tend to promote good health and vigour A growing cockerel may be ever so healthy and possess ever such a strong constitution, but if subjected to such treatment it well may be expected that the bird's vigour will be impaired In the case of breeds with large combs, such as Leghorns, Minorcas, &c, leg weakness usually is accompanied by a falling-over of the comb. Confinement with insufficient room to exercise and an over-supply of rich food cause extreme development of the comb, and a consequent falling-over of this ornamental feature by reason of its extreme weight. Where birds are to be marketed young and in prime condition, forcing food as well as confined quarters is necessary in order that the birds may make the greatest growth possible in the shortest space of time. The highly forced male, however, is not one to be regarded as a desirable bird for heading the breeding-pen. The fact that a bird is weak in the legs indicates that it has been weakened through improper management, or that it possesses an hereditary weakness as a result of an impaired constitution. Once a bird becomes affected in this way it is useless to try to correct it: prevention is the one thing to aim at. The essentials for this purpose are breeding from only healthy parents, giving the young birds an ample supply of plain but nourishing food, and a liberal range under the most natural conditions possible. Further, if leg weakness is to be prevented and the young birds are to have the desired thickness and quality of bone, it is imperative that the growing stock, whether cockerels or pullets, be well provided with broken sea-shell throughout all stages of their development as a means of supplying the necessary lime for the manufacture of bone and other bodily requirements.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Work.

During the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies by this means are reduced to the verge of starvation by the spring. It is the work of only a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble the entrance should be contracted.

Control of Wax-moth Pest.

In districts where wax-moths are troublesome, particularly the large one (*Galleria mellonella*), a periodical examination should be made of all extracting combs. These moths do an enormous amount of damage, particularly in the off season, and especially in districts where mild weather conditions prevail. The moths attack not only the dry combs, but also combs of honey stored for spring feed.

Where the moth is prevalent in large numbers it is essential to have a special comb-room, constructed so as to be nearly airtight and filled with racks on which to suspend the combs to enable fumigants to penetrate the cells. Where only a few combs have to be dealt with these may be stacked in supers, spaced eight to the super, care being taken to see that the junctions of the boxes are made smoketight by pasting a strip of paper round them. The top box of the pile should contain no frames. Into this it is necessary to place an iron saucepan containing wood embers, and on these to throw a small quantity of sulphur. The supers should be closed securely, and kept closed for a couple of days. In from three weeks to a month a second fumigation should be given.

Bisulphide of carbon may be used to accomplish a similar result. In using this chemical the combs may be stacked in a tight box or supers. If the latter are used all cracks require to be closed with paper pasted on the outsides to prevent the fumes from escaping. A quantity of the bisulphide should be placed in an open dish on top of the combs. The liquid evaporates and the fumes, being heavier than air, settle over the combs, thus effectively killing the moths. This operation may have to be repeated during the winter months. Great care must be taken when using the bisulphide, as it is highly explosive and dangerous, and on no account should a fire or light be allowed near the liquid when being used.

For the efficient control of the wax-moth, Cyanogas (calcium cyanide) may be used, and is more effective than the fumigants previously mentioned. The active agent of calcium cyanide is liberated in the form of hydrocyanic acid gas, which is a most deadly poison to all life. However, it can be used with safety because the liberation of the gas from the powder is slow, thus allowing the operator to retire after giving a charge. Fumigation of combs may be done in supers, after taking the precaution of making them gastight, in the same way as when using sulphur or bisulphide. The calcium cyanide should be sprinkled finely on newspaper, and the dosage placed at the bottom of the stack. In the event of a comb-room being used, the supers containing the combs may be stacked criss-cross or placed on the racks usually provided No other preparation is necessary. In operation the calcium cyanide powder should be sprinkled on paper and placed here and there about the comb-room. For super fumigation the recommendation is to use a dose of 4 lb. to 1,000 cubic feet of space. Half the quantity will suffice for airtight comb-rooms. These dosages will kill the moths in all stages. As already indicated, the gas, being deadly to all life, should be handled with great care. The writer has used calcium cyanide in the open air for killing bees and has watched its deadly results. Caution, however, is necessary when the chemical is used in buildings. The operator should leave the building

as soon as possible, and lock the doors and windows. Twenty-four hours' treatment will suffice, after which the door of the room should be opened to allow the gas to escape, and the building should not be entered for from two to three hours.

There is no danger of poisoning honey in ordinary fumigation with calcium cyanide ; consequently combs of honey stored for spring feed when attacked by the wax-moth may be fumigated in a similar manner to dry combs, and the combs of honey so treated may be fed without injury to the bees.

Plans for next Season.

The off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are in urgent need of room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees are in a dormant condition, the best methods of improving his stocks. Neither weather conditions nor locality nor any other factor influences the honey-crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Planting-season.

WELL thought-out plans for the establishment of shelter-belts, hedges, and shade trees and for plantations for the supply of firewood and posts, and the control of watercourses, may be carried out during the planting-season for hardwood plants which extends from the months of May to September inclusive. In warm districts the season for the removal of deciduous plants may be somewhat delayed owing to the shorter dormant period, also in the drier localities late planting has rather serious risks.

Plans for such permanent improvements require leisurely consideration over an extended period, so that consideration is given not only to one's own tastes but also to the suitability of the plants for the locality and purpose in view, and also to the arrangement, extent, and position of each feature. Where this has been done and the land given what preparation may be necessary and fenced off from stock, the plants may be set out as soon as possible in fine weather with excellent prospects for a good start. Where the land is wet and cold at midwinter, planting should not be done at that period, and, where plants are small and somewhat tender, planting in spring is to be preferred.

In any case where the plants are to be purchased it is advisable to take delivery as soon as they are available, and if they are not planted immediately they should be "heeled in" in a piece of friable soil that is well drained and conveniently placed. This is done by opening a trench and setting the plants in it close together, then returning the soil and treading it firm. In this position they will keep their condition and be available for planting out at any time during the season. If the plants have come a long distance they will be tied in firm bundles and may be somewhat heated, in which case they should be released and allowed to air in a well ventilated shed for twenty-four hours before "heeling in." During this period the roots should be moist and covered to prevent them drying excessively.

Plants generally selected for these purposes are redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga Douglasii*), Lawson's cypress (*Cupressus Lawsoniana*), macrocarpa (*Cupressus macrocarpa*), Bentham's Cypress (*Cupressus Benthami*), insignis pine (*Pinus radiata*), prickly-cone pine (*Pinus muricata*)—all natives of the Pacific Coast of North America. Also to some extent and quite successfully on a clay soil use is made of the Japanese cedar (*Cryptomeria elegans*). These are all fine conifers giving excellent results when planted in suitable, well-drained positions. On a rich deep soil macrocarpa and insignis pine become so coarse as to be of little use for timber or shelter; on land with a high water-table they are also unsatisfactory. Clay soils unsuitable for Lawson's cypress may be planted with Bentham's or the Cryptomeria; and to assist in forming a close margin the prickly-cone pine is often useful on account of its heavy foliage.

There are also the species of Australian eucalyptus which hardly can be excelled for firewood and posts. *E. Macarthuri* and *E. viminalis* are most popular, as they are of quick growth and hardy, and the timber has good lasting qualities. For alluvial land inclined to be wet and sometimes flooded species of willow and poplar are most suitable for providing shelter and shade.

For farm hedges barberry (*Berberis vulgaris*), boxthorn (*Lycium horridum*), and *Elaeagnus japonicus* are most frequently planted—the last only on a comparatively poor soil where it is useful in affording shelter at ground-level in a plantation.

Native evergreen shrubs hardly fulfil the requirements of a stock-proof hedge, but for good shelter up to about 15 ft., especially by the seaside, the native olearias and pittosporums, planted about 3 ft. apart, are most effective and require little attention once they are established.

For shade trees or an avenue, sweet chestnut (*Castanea sativa*), or, in good alluvial land in a dry district, the walnut (*Juglans regia*), serve very handsomely, and also provide a useful crop of nuts.

For the establishment of hedges and shelter-belts, the land should be in a good state of cultivation, and maintained in that condition for a few years to obtain the best results: on steep broken country the growth of natural herbage is generally less vigorous and trees establish themselves satisfactorily without such good preparation, which, in any case, is practically impossible under the circumstances. For successful planting it is indispensable that the land be sufficiently dry to be friable; the plants should never lie with roots exposed to the air and light, and they should be planted to the same depth as they have been grown, and, lastly, the soil placed about the roots of the young plant must be made thoroughly firm by treading.

When conditions are suitable for planting it is advisable to lift the plants and examine them critically: young yearlings that have been "wrenched" or grown in boxes will require no pruning; others may have straggling roots which should be shortened back. Older plants very possibly have roots that are bruised or broken; these should be trimmed back to sound growth with sharp shears and straggling roots should be shortened. Where branches are crowded, at the main forks especially, those awkwardly placed should be cut out completely and neatly. After these attentions the plants are packed, with plenty of wet hessian protecting the roots, and conveyed to the site where the planting is to be done. For stock-proof hedges the plants are set from about 12 in. to 15 in. apart. A single-line shelter of cypress, olearia, or pittosporum may be planted 3 ft. apart where a height of about 15 ft. is desired: that spacing is also suitable for Lombardy poplar, although it is often planted 2 ft. apart where shelter is not required much over 20 ft. in height. In a shelter-belt of greater width the trees may be planted alternately, at a distance of 6 ft. or 8 ft.

There are different methods for planting broken country, but it is often useful to plant along a line indicated by 6 ft. sighting rods driven into the ground at intervals. It is advisable to skim the turf off an area about 2 ft. square on this line, break up the ground with the spade, which is afterwards driven in deeply and vertically, and then levered to one side while an assistant places a tree in position and makes the soil firm about it by treading. The distance to the next planting site may be measured with the spade and the action repeated. When a sighting rod is reached it is necessary to measure the distance carefully to the right or left and the line will be laid for the next row. Plants left over at the end of the day should be "heeled-in" carefully on the spot, so that if wet weather, &c., should stop the work for a while there will be no loss.

Small and Sundry Fruits.

In this country bush-fruits are planted among tree-fruits to only a very limited extent, and rarely can such planting be recommended. It may be done with advantage sometimes when establishing the home orchard in order to obtain a return while the trees are becoming established. When deciding on the kinds for planting it is necessary to consider the demand for the crop, both for domestic and commercial purposes, then comes the consideration of the suitability of the climate, and of the soil and of the preparation of the soil. Gooseberries, currants, and raspberries thrive best in the cooler districts, an open situation and rather light land suiting gooseberries and red currants, whilst black currants and raspberries require a good loam where moisture is always present as well as good shelter from prevailing winds. To be avoided carefully is the planting of these bushes in the vegetable garden, even on its verge, as their interests clash with those of vegetables. The deep cultivation required for vegetable crops is injurious to the fibrous roots of the bushes, and the shade and competition of the bushes is detrimental to the vegetable crops. These berry crops are generally best planted in a block in a section of the home garden specially reserved for perennial crops, such as asparagus, rhubarb, and herbs, as the plants named have very much in common and there is little chance of their doing one another an injury. Commercial crops are set in a well-hedged paddock with probably high shelter on the weather boundary. The distance between rows and plants will vary with the quality of the land and the variety being planted, but for gooseberries and currants it should not be less than 5 ft. For black currants and raspberries it is generally advisable to plant the rows 6 ft. apart and 3 ft. between plants, the raspberries being planted in groups of three canes. A very good alternative method of planting raspberries is to set the canes singly 1 ft. apart in the row.

In the warmer localities most of the following fruits may be grown on suitable land. The Cape gooseberry (*Physalis peruviana*) is a herbaceous plant cut down by frost in winter, but shooting again from the crown in spring. Good forward plants set out 3 ft. apart and 6 ft. between rows, in a light, rich, warm soil, during the early part of November should crop well during the autumn for two or three seasons. The tree-tomato (*Cyphomandra betacea*) is enjoying an increasing popularity. This half-woody plant with large soft leaves grows here usually to a height of about 6 ft. It should be planted about 3 ft. apart in a fertile soil with ample shelter. The crop ripens in winter when not many kinds of fruit are available. The guava and also the feijoa are fruiting-shrubs from the warmer parts of South America. Planted as informal hedges in the less exposed positions they should crop satisfactorily if the soil is good and care has been taken in the choice of varieties. Seedling plants may be bought cheaply, but they are rarely so good as selected varieties grown from cuttings, &c.

The Chinese gooseberry (*Actinidia chinensis*), the passion-vine (*Passiflora edulis*), the loganberry, and the grape-vine are all vines requiring support,

which usually takes the form of a post and wire fence from about 4 ft. to 5 ft. high, but a wall with strained wires at intervals or a pergoda is very suitable for the purpose in the home garden. As the *Actinidia* is commonly diœcious—that is, it has staminate and pistillate flowers on different plants—both kinds must be planted to produce fruit. In a rich, moist soil the fruit is produced fairly abundantly, and ripens in winter.

Fruiting-trees of moderate to fair height and suited to a mild climate are the loquat (*Eriobotrya japonica*), the avocado (*Persea gratissima*), the olive, the fig, and the pomegranate. The first three are evergreens and the remainder deciduous, but they are alike in requiring a light, deep soil. A number of unsatisfactory trees of the kinds above mentioned are growing in many parts of the country. In a few instances the soil or climate may be unsuitable, but, generally, poor results are due to the fact that the trees are seedlings and comparatively worthless under any conditions, or the variety is not suited to the locality. Planting as a rule should not be done unless the variety has proved itself suitable to the locality or to one very similar. The avocado is indigenous to Mexico and Central and South America, but is now distributed in most tropical and subtropical countries. Those varieties likely to do best here are those derived from varieties growing in Mexico, where, growing for centuries at an altitude of from 6,000 ft. to 7,000 ft., they easily withstand fairly sharp winter frosts. The introduction of some of the trees mentioned has not been carried sufficiently far to warrant commercial planting at present, but selected varieties are certainly worth a place in the home garden, as their beauty and utility are considerable.

Apples and pears, stone fruits, and citrus are dealt with under another heading in this *Journal*.

The Homestead Garden.

In the established garden the planting-season affords an opportunity for considerable rearrangement of trees and shrubs, if that is necessary, or for supplementing plantations and borders, especially with plants which require the shade and shelter of well-established growth in the vicinity. The planting season is an opportunity also to try one or two novelties about which reports have been good, to see how they respond to local conditions—*e.g.*, one or two new roses that have received awards, a new bougainvillea, or a few of the new hydrangeas, barberries, or brooms.

In the case of the new garden the planting-season is all important: it will be best to confine attention almost entirely to well-proved material, for really good effects with trees and shrubs that have not been proved under local conditions are unlikely. With very few exceptions, it will be wise to confine the planting, for a few years, to trees and shrubs of known worth. One principal that may be laid down definitely is that the shelter and shade trees chiefly should be of native evergreens, and that some of the characteristic plants such as tree-ferns, nikau-palm, cabbage trees, toetoe, and flax should sooner or later find a place. For the New Zealand landscape and climate nothing can altogether take the place of the native plants: even if we accept a charge that they are sombre, which they are not entirely by any means, native evergreen trees and shrubs of shapes, sizes, and shades make an indispensable shelter and background for such favourite flowering shrubs and trees as rhododendrons, azaleas, roses, cydonias, syringa, philadelphus, forsythia, camellias, weigelia, daphne, broom, magnolia, fuchsia, and hydrangea. The most interesting garden perhaps is one where the number of genera is lower than usual, and the number of species is increased; or, stating it another way, fewer kinds of shrubs and more varieties or species of those kinds.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MORTALITY IN YOUNG PIGS.

C. B., Westport :—

Ten pigs born at the beginning of December seemed to have nothing wrong with them, being very fat and healthy looking Three died through Christmas week, three last week, and one this morning.

The Live-stock Division :—

The cause of death amongst your young pigs would appear to have been of a dietetic nature The sow herself may have been at fault in not providing sufficient nourishment Has she raised a large litter successfully before ? Again, the food supplied may have been an unbalanced ration for a sow to rear successfully a large litter The mortality of the seven young pigs having occurred over a period of three to four weeks is an indication that the trouble was caused by some digestive disorder, and was not due to heart trouble as you were advised

REMOVAL OF GREEN DISCOLORATION OF WATER.

C. McL., Waipu :—

After standing in the tank for a day or two, artesian water possesses a green tinge, and after standing in the concrete troughs of 300-gallon capacity for a week the water becomes very discoloured by minute green "particles," and is not suitable for watering stock. The water is crystal clear when pumped Is there any means of preventing the growth of the green particles ?

The Chemistry Section :—

Green growth in water cannot take place in the absence of daylight Hence if the pure water is pumped into a tank from which light is excluded and fed into troughs where the light is partially excluded there will be no discoloration by minute green "particles," which are merely a low form of plant

EARLY WEANING OF FOAL.

J. W. D., Methven :—

It is desired to wean a well-grown draught foal (dropped 1st October, 1934) as early as possible in order to get use of the dam, but this without prejudice to the foal, which will eat hay, chaff, &c , as it has eaten such with the dam Foal is in very good condition and the picture of health

The Live-stock Division :—

Usually foals are weaned when about six months old, but when the mare is required for work they can be weaned at an earlier date As the foal is already accustomed to chaff, &c , she could be weaned in March In order to treat her well it would be advisable to add a little crushed oats and bran to the chaff, which should be given in small quantities three or four times a day in addition to the grazing that is available. Plenty of fresh water is also necessary for young stock

ADVISABILITY OF STRONG HIVES IN WINTER.

Amateur, Mangamingi, Eltham :—

Why is it advisable to have strong hives to start the winter ? I understand that the worker bees now in the hive do not survive to do any useful work next summer. So why feed the whole lot—if a number were killed it would leave more food for the spring ?

The Horticulture Division :—

In temperate and colder regions there is a period of quiescence in the winter with close clustering of the bees, subject in the cold weather to periodic

disturbance for raising of the temperature. When the surrounding atmosphere in the hive is low enough to cause danger to the life of the bees, then extra heat must be generated and pass from within the cluster to maintain the temperature of the bees on the outside The closer the cluster the better is the heat retained and the smaller the external surface The mass of bees and heavy old comb and of any stores within the cluster has considerable heat storage capacity, but the heat has to be maintained by the combustion of food in the bodies of the bees within the cluster A strong hive with a larger number of bees has less external surface for a given volume than has a weak hive with fewer bees.' If the number of bees is halved the amount of external surface of the cluster relative to the number of bees is increased, and more heat must be generated per bee to keep up the outside temperature Moreover, the air will pass more readily through a small cluster than a large one, and it seems that this considerably intensifies the burden of maintaining the temperature in a small cluster. The saying that the best packing for bees is bees has its justification in practice and theory The young bees reared in the autumn survive the winter period and are essential to the life of the colony in the spring, maintaining their activities until sufficient young bees are reared to ensure the colony against death.

OAT VARIETIES, HARVEST OF 1934.

Simultaneously with the collection of particulars relating to wheat recorded on page 47 of this *Journal*, January, 1935, information was also obtained from proprietors of threshing-machines in respect of oats threshed by them. The figures relating to oats are shown in the following table.

Altogether, the threshing returns accounted for 73,270 acres of oats out of a total area of 78,343 acres ascertained to have been threshed for the season 1933–34.

Variety of Oats threshed	Area threshed.	Total Yield.	Average Yield per Acre.	Per Cent. of Total Area.	Percentage of Total Yield.
	Acres.	Bushels.	Bushels.		
White	50,364	2,485,990	49·36	68·74	74·38
Dun	7,161	266,039	37·15	9·77	7·96
Black	2,364	97,122	41·08	3·23	2·91
Algerian	13,381	492,894	36·84	18·26	14·75
Totals	73,270	3,342,045	45·61	100·00	100·00

—*Census and Statistics Office.*

DAIRYING INDUSTRY, 1933–34.

Dairy factories reporting operations during 1933–34 numbered 482, as against 478 in 1932–33. Persons employed in this industry totalled 4,346, or 5 per cent. more than in 1932–33, but salaries and wages paid receded a shade. The cost of butterfat purchased by factories—*i.e.*, pay-out—advanced from £13,498,797 in 1932–33 to £14,790,990 in 1933–34, an increase of almost 10 per cent Milk and cream cartage costs increased by 7 per cent., and an advance of 14 per cent. is recorded for the cost of materials used The value of products (based on the price ruling at the factory) rose from £16,612,981 in 1932 33 to £17,911,129 in 1934–34, or by 8 per cent.

Butterfat amounting to 391,961,202 lb. was sent to dairy factories during 1933–34, this quantity being 8 per cent. greater than for the previous year. Of this amount 75 per cent. was used for buttermaking and 24 per cent. was required for cheesemaking, while the remaining 1 per cent was utilized for the manufacture of condensed and dried milk, &c. Butterfat for buttermaking, cheesemaking, and condensed and dried milk, &c., making during 1933–34 was 10 per cent., 3 per cent., and 1 per cent. respectively more than in the preceding year.

The quantity of butter produced during 1933–34 is the highest yet recorded, being 9 per cent. greater than in the previous year. The value of butter produced increased from £11,378,210 in 1932–33 to £12,521,267 in 1933–34, an advance of 10 per cent. Whey butter produced increased by 6 per cent. in quantity and 2 per cent. in value. Cheese showed an upward movement of 3 per cent. for quantity, but the value remained practically stationary.

WEATHER RECORDS: MARCH, 1935.

Dominion Meteorological Office.

NOTES FOR MARCH.

MARCH was a very satisfactory autumn month. The warmth and lack of wind led to rapid growth of vegetation, and a good supply of winter feed is assured. The only extensive area still suffering from a shortage of rainfall is North Canterbury. Parts of the Southern Wairarapa, also, are still dry. Stock generally are reported to be in good condition, and the milk-yield has recovered. There was much dull and damp weather in the first part of the month on the east coast of the North Island north of Hawke's Bay, and this had an adverse effect on sheep, a considerable amount of facial eczema being reported. Crops have done better than seemed probable earlier in the season.

Rainfall.—Except in the Auckland and Hawke's Bay Provinces, the first half o the month was very dry, but in the latter half there were general rains, with heavy falls at most places. In Central, and especially North, Canterbury the total rain was below average Hawke's Bay and parts of the interior of the North Island also had less than normal. On the west coast of the South Island conditions were irregular, but on the whole did not differ greatly from average. Over the rest of the country there was an excess. Many places in North Auckland, Taranaki, Nelson, Marlborough, and Otago had double the average

Temperatures. Temperatures were again considerably above normal, the departures ranging mainly between 1·5 and 3·0°. The one exception was Hawke's Bay, where the mean for the month was below the average. Some snow fell on the mountains on the 26th and 27th, but most of it subsequently disappeared. A few light frosts were recorded.

Sunshine.—Sunshine was unusually abundant on the West Coast and in the far southern portions of the South Island. On the east coast of the North Island, from Hawke's Bay northward, there was a considerable deficit, and this probably accounted for the low temperatures in that area. Elsewhere the totals did not differ greatly from normal.

Pressure Systems.—In the first part of the month there was very little storm activity over the Dominion. On the 3rd and 4th a depression moving from the north past East Cape caused heavy rains north of Hawke's Bay and in parts of the Bay of Plenty area.

Between the 10th and the 14th a depression passed slowly by the northern extremity of the North Island and was responsible for north-easterly gales and heavy rains in most of the Auckland Province. Very severe flooding occurred in North Auckland.

The first general rains were associated with a rather complex storm system which was active over the country from the 15th to the 19th, the 17th being generally the wettest day. Floods occurred again in North Auckland and Taranaki, while few districts escaped very heavy falls.

From the 12th to the 17th pressure was high to the east of New Zealand, at Chatham Islands, a state of affairs which had characterized the dry weather of the early part of the summer. After the 17th, however, there was a definite change, and weather of a westerly type has since predominated.

Further general rains occurred during the passing of another series of depressions between the 24th and 27th. Very heavy falls were experienced from Taranaki and Wellington southwards. Taranaki had its third series of floods within five weeks. There was some flooding, also, in Southern Otago and Southland.

Many thunderstorms were experienced during the month, especially in the Auckland Province, and some were very severe and prolonged.

Between the 19th and 23rd a tropical cyclone developed in the Pacific Islands region and passed through the Tonga Group in a south-easterly direction. Fortunately no serious damage was done.

Rainfalls for March, 1935, at Representative Stations.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·99	15	2·58	3·10	16·34	10·54
Russell	13·57	15	3·20	3·28	28·85	9·52
Whangarei	11·51	12	4·90	4·45	23·63	12·25
Auckland	4·38	15	2·02	3·02	16·24	8·86
Hamilton	1·79	10	0·60	3·76	6·92	10·24
Rotorua	10·78	13	4·62	3·49	18·58	11·44
Kawhia	5·26	10	2·90	4·21	13·26	9·83
New Plymouth ..	5·95	11	2·25	3·72	20·03	11·70
Riversdale, Inglewood ..	8·31	10	2·96	7·04	32·95	20·58
Whangamomona ..	6·38	6	3·59	4·98	26·48	14·45
Hawera	6·46	7	3·20	3·01	16·55	8·92
Tairua	10·36	17	1·90	5·21	21·74	13·55
Tauranga	8·50	14	1·30	3·98	13·15	11·57
Maraehako Station, Opotiki	5·97	10	1·39	3·96	14·40	11·69
Gisborne	3·90	11	1·48	4·42	9·91	10·60
Taupo	2·27	10	0·55	3·14	14·26	9·25
Napier	1·25	10	0·34	3·13	7·53	8·84
Hastings	1·58	10	0·58	2·76	6·34	6·94
Whakarara Station ..	2·41	15	0·52	..	12·04	..
Taihape	1·30	7	0·43	2·61	9·46	8·00
Masterton	1·05	7	0·31	2·81	5·53	8·14
Patea	4·43	10	2·20	3·35	15·53	9·34
Wanganui	2·68	8	1·11	2·47	12·66	7·72
Foxton	2·81	7	1·10	1·98	7·90	6·19
Wellington	3·79	8	2·31	3·11	9·06	8·59
South Island.						
Westport	6·03	13	1·51	7·50	24·17	21·05
Greymouth	6·38	11	1·32	8·80	28·03	24·18
Hokitika	9·80	12	2·31	9·04	37·45	26·90
Ross	6·67	9	2·10	10·73	32·31	32·03
Arthur's Pass ..	14·29	7	5·00	13·19	47·43	37·21
Okuru, South Westland	13·24	7	4·35	14·15	44·12	36·40
Collingwood	9·45	14	2·73	5·81	17·96	17·68
Nelson	7·54	12	2·82	2·91	13·77	8·35
Spring Creek, Blenheim	4·16	8	2·23	1·98	5·80	6·38
Seddon	2·36	9	1·20	2·00	4·17	5·69
Hanmer Springs ..	1·83	7	0·54	3·20	7·72	10·30
Highfield, Waiau ..	1·27	4	0·54	2·84	4·88	8·42
Gore Bay	1·00	7	0·23	2·13	5·35	7·39
Christchurch	1·22	11	0·56	1·98	3·03	5·90
Timaru	1·98	6	1·21	2·20	6·59	6·31
Lambrook Station, Fairlie	1·78	8	0·94	2·34	6·36	6·58
Benmore Station, Clearburn	3·70	8	1·58	2·41	9·23	6·80
Oamaru	3·69	12	2·22	1·78	6·97	5·61
Queenstown	5·54	12	2·50	2·61	11·81	7·47
Clyde	2·33	8	1·39	1·49	5·94	4·40
Dunedin	5·73	14	2·67	2·94	11·17	9·10
Wendon	5·91	10	1·74	2·74	11·79	8·20
Balclutha	4·64	10	2·03	2·31	10·32	6·61
Invercargill	4·90	14	1·02	3·87	13·62	11·00
Puysegur Point ..	7·11	16	1·66	7·97	23·65	21·33
Half-moon Bay ..	4·44	20	1·03	5·37	13·61	14·27

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POTATO-GROWING IN NEW ZEALAND.

PART I.—ADVICE TO GROWERS IN REGARD TO THE MAINTENANCE OF PURE AND HEALTHY SEED-STOCKS.

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MOST growers recognize the necessity of using "good seed," but very few of them could define at all correctly what are the essentials of seed that might be termed good nor the factors that render seed unproductive. The purpose of this article is to discuss these matters from the point of view of the grower, to guide him in the purchase of seed, and to help him to maintain his seed-stocks in a pure and healthy condition.

If seed of one variety is collected from many different growers and all the seed is grown at one centre where each line has an equal chance of development, it will be found that some lines far outyield others. This variation of what might be termed "cropping-power" cannot be detected by an inspection of the seed-tubers, but necessitates an inspection of the crop in the field.

All growers aim at heavy yields, and in this objective the most important factor is the use of productive seed. The initial outlay in the purchase of such seed may be slightly greater, but rent and cultivation charges are the same, and it costs more per ton to dig a light crop than one that is heavier.

Preliminary investigations undertaken at the Ashburton Experiment Farm in the season 1927–28 revealed the fact that commercial stocks of seed were badly mixed, often wrongly named, and in many cases unproductive. It was found, moreover, that those who were dissatisfied with their crops—that is, those who had the least productive lines of seed—sold these and bought others, but bought with no assurance that they were not receiving some other grower's discarded seed poorer than their own.

The Department of Agriculture decided, therefore, to remedy this by investigating the varietal position and preparing descriptions of all the more important varieties, by commencing the production of high-quality seed for distribution to growers, and finally by inaugurating the certification of seed potatoes.

THE WORK OF THE DEPARTMENT OF AGRICULTURE.

The first step was necessarily the sorting-out of varieties and the preparation of descriptions by which they could be recognized. These type descriptions, now completed, form the second part of this article.

The second, and really more important step, was to study the factors that were lowering the productiveness of a large proportion of potato crops. It was proved most convincingly that a group of diseases collectively known as "virus" diseases was primarily, and in most cases wholly, responsible, and that these diseases were transmitted from plant to plant in the field, and from season to season, by means of the tubers. This knowledge led to two lines of action. Firstly, steps were taken to raise, by means of selection, lines of seed as far as possible free of virus disease. This work, started at the Ashburton Experimental Farm, is now one of the more important activities of the Government Pure Seed Station at Lincoln, from which institution seed-stocks of all the more important varieties have been available to growers each season. Secondly, the Fields Division commenced in 1927 a system of seed-certification involving the trial of samples, the inspection of crops, culminating in the certification of such seed as had attained the necessary standard. The influence of certification upon the general standard of potato crops has been very striking. During the first few years from 25 per cent. to 30 per cent. of the crops were rejected on account of impurities. This was reduced in 1932–33 to below 1 per cent., and this past season of 1933–34 428 crops were inspected and there were no rejections on this account. The reduction in virus diseases has also been very marked, but the rapid distribution of virus disease in the field renders it less amenable to control. Nevertheless, it has been possible to tighten up the standards very considerably and yet to pass each season approximately the same proportion of crops.

The Purchase of Seed.

The grower who is not getting satisfactory results from his potato crop is advised to purchase certified seed. It may be too expensive to purchase sufficient to plant his whole area. If this is the case he should obtain sufficient to plant a seed-plot to supply his own requirements the following season. Two classes of certified seed are available, mother seed and commercial seed. The latter class, although not eligible for further certification, can be expected to give a good crop under average conditions. It will suit the grower who finds it necessary to purchase fresh seed at frequent intervals, and who requires a good line at a reasonable price. Mother seed, on the other hand, includes the best lines available, and is eligible for re-entry into certification. It should be purchased whenever possible, and always when the grower desires to make a business of growing for the seed trade.

The Maintenance of Pure Seed-stocks.

The purchase of certified seed must be regarded only as the first step towards crop-improvement. Such seed requires to be cared for if its standard is to be maintained. The chief method of maintaining this standard is by "rogueing"—*i.e.*, removing—all plants that appear for any reason at all to be not quite normal. It is not difficult to maintain varietal purity if reasonable care is taken. Unless a straight-out mixture of foreign varieties occurs, there are very few rogues that need trouble our New Zealand crops. Northern Star, or Gamekeeper, is the chief offender among the white skins. Because of its habit of producing a large proportion of seed it multiplies rapidly and tends soon to become

dominant in a crop. Leader and Scotia are two rogues which have caused trouble in the Dakota variety. The former is distinctly yellow-fleshed, and the latter turns dark on cooking, two very undesirable characteristics.

Rogues (foreign varieties) may be introduced into a line in a number of ways, and the greatest care in handling the seed is desirable. The accidental mixture of two varieties is always possible. Growing a crop on ground already carrying self-sown potatoes is perhaps the most common practice leading to mixing, and for this reason potatoes should not follow too closely after potatoes in the cropping rotation. Land in the vicinity of old potato-pits is always likely to carry self-sown tubers, and this should be kept in mind when growing for seed. Where two varieties are being grown in the one paddock, a break of some other crop should intervene. Even the differential effects of disease on two varieties may allow a rogue in a stock to multiply more quickly than the variety.

Rogueing should commence before the seed is planted. Apart from the beneficial effects on the succeeding crop, sprouting of the seed is one means of identifying rogues. Thus the pink sprouts of Northern Star contrast plainly with the purple sprouts of Arran Chief. The next rogueing for purity will probably take place at flowering-time It is not necessary for the grower to be able to name all the rogues. He should have, however, in his mind a definite picture of the variety he is growing, and remove any plant that does not agree in all characteristics with this standard. Flower-colour, or even absence of flowers, is a definite means of locating some rogues, and at the flowering stage the general habit of growth of the plants also is clearly distinguishable. Unless influenced by disease, time of maturity is a very definite varietal characteristic and affords a useful guide for rogueing. Thus all plants of late maturity should be removed from the early variety, and *vice versa*. In all cases examination of the immature tubers leads to a more certain conclusion than inspection of the mature tubers, especially after pitting. In the former case the skin-colour and characteristics of the eyes are more readily distinguishable.

Variations known as "bolters" and "wildings" are to be found in many varieties. Bolters may be observed commonly in Up-to-Date and Epicure, and are recognized very easily in the latter. The plants are tall and of later maturity, produce a relatively large number of flowers, and may be more resistant to such diseases as late blight. The stolons are long and the tubers generally large and coarse. Such plants should be rogued, for they represent an undesirable variation from the normal, more especially in an early variety such as Epicure. Wildings are short in growth and produce an abundance of stems bearing no flowers. As might be expected, such plants produce a large number of tubers of seed-size with few table potatoes, and if they are not removed the stock deteriorates very rapidly.

The Maintenance of Healthy Seed-stocks.

While it is a relatively simple matter to keep a variety pure, the maintenance of a vigorous, disease-free stock is a much more difficult matter. Degeneracy or "running out" of a line is mainly brought about by a group of diseases known collectively as virus diseases.

That low yield and a high percentage of virus infection are correlated has frequently been demonstrated, and the following figures are quoted as a typical example.

Number of Lines in each Group.	Limits of Yield in each Group, in Tons per Acre, of Cropping-power.	Average Percentage of Virus Infection for the Lines of each Group.
1	11·5–11·9	7
Nil	11·0–11·4	..
4	10·5–10·9	16
2	10·0–10·4	16
6	9·5– 9·9	18
5	9·0– 9·4	17
6	8·5– 8·9	18
5	8·0– 8·4	19
4	7·5– 7·9	20
7	7·0– 7·4	22
9	6·5– 6·9	23
11	6·0– 6·4	33
6	5·5– 5·9	37
11	5·0– 5·4	43
6	4·5– 4·9	43
4	4·0– 4·4	45
3	3·5– 3·9	62
1	3·0– 3·4	61
4	2·5– 2·9	68
1	2·0– 2·4	76
1	1·5– 1·9	94

These results were obtained in New Zealand in the certification-tests which are essentially concerned in identifying stocks, which, among other considerations, are relatively free from virus diseases. The following figures published recently in a report of results obtained at the Plant Research Station, Palmerston North support the soundness of using certified seed, and are quoted here to demonstrate how rapidly seed may deteriorate.

	Tons per Acre.
Certified seed averaged	14·3
Seed once grown from certified seed averaged ..	11·6
Seed twice grown from certified seed averaged ..	10·1
Seed three times grown from certified seed averaged	10·1
Uncertified seed averaged	7·6

ROGUEING FOR VIRUS DISEASE.

Virus diseases are carried over from year to year in the seed, but an examination of the tubers does not reveal their presence. In fact, such tubers often keep better than healthy seed. The virus is carried in the sap of the diseased plants, and is capable of setting up the same disease in another plant, when it reaches the sap of that plant, by inoculation or by grafting. In the field such inoculation takes place by

means of insect agencies, chiefly aphides, which, when moving from plant to plant, carry infection on their feeding parts. Only by inspection of the growing crop can the presence of these diseases be detected, and therefore it is to the growing crop that attention must be paid. If a stock is badly infected, rogueing is not worth while. Such seed should be discarded and a good certified line procured, and to keep even such stock healthy thorough and persistent rogueing is necessary. Since infection is transmitted in the field it is necessary to rogue as early as possible, about six to eight weeks after planting. For practical purposes it is not necessary to identify each disease, a much more thorough rogueing will be accomplished if every apparently weak or unhealthy plant is removed. Windy and showery weather should be avoided, and bright sunlight is not desirable, as the shadows cast by the upper leaves are confusing. Dull, calm weather is the most satisfactory. If it is imperative, through pressure of other work, to rogue on a sunny day, then the operator should keep his back to the sun, which will mean working in one direction only.

RECOGNIZING VIRUS DISEASE.

Authorities differ in classifying the many virus diseases: a plant may carry more than one of them, and their actual identification becomes very difficult. The following notes will assist, however, in the recognition of the more common.

Leaf-roll.—In this virus the lower leaves are rigid, the leaflets thickened and harsh, and rolled upwards and inwards, making the leaf funnel- or spoon-shaped. The rolled leaflets are crisp and dry, and rustle when the plant is disturbed. When a healthy plant becomes infected during the growing season there may be no visible sign of infection, but occasionally a *stiff* upward rolling of the topmost leaves takes place, extending progressively to the lower ones. Other diseases, particularly stem-troubles, are the more usual cause of the upper leaves curling, but stem-troubles are usually accompanied by a certain amount of wilting. In leaf-roll the old sett is not generally exhausted. All stages of infection occur, and in severe cases the plant becomes much dwarfed and incapable of yielding table-sized tubers. Unfortunately, the produce from such plants normally finds its way into the seed from which next season's crop is propagated. Aphides and other insects distribute the disease in the field, and the seed-tubers from infected plants carry the trouble from one season to the next and from one grower to another.

Mosaic.—Several types of mosaic have been described, and each is now recognized as a distinct virus. In the usual form, instead of being uniformly green, the leaflets are mottled with pale green patches. This condition is recognized most easily if the plant is shaded from the direct rays of the sun. In severe cases the foliage becomes paler, the growth more open, and the leaflets very much wrinkled or the margins of the leaflets waved. The whole plant is dwarfed and the yield considerably reduced. The mottling is to a large extent masked in hot sunny weather, and recognition of mild mosaic becomes very difficult. Infection is carried in the same manner as in the case of leaf-roll.

FIG. 1 MILD MOSAIC.

FIG. 2. LEAF-ROLL.

Crinkle.—In many ways this disease resembles severe mosaic. The plants are always very much dwarfed and the leaves crinkled. This appearance can be detected almost as soon as the plants are through the ground. The leaves are very much mottled and curled downwards. The lower leaves often turn brown and drop off and the plant matures at an earlier date than healthy plants. The yield is greatly reduced.

Stipple-streak.—In attacks of this virus the leaflets develop characteristic dark angular spots, which spread down the veins of the leaflets and extend to the midrib of the leaf. In advanced

FIG. 3. LINE OF POTATOES (CENTRE ROW) BADLY "RUN OUT" WITH LEAF-ROLL.

Such plants are a menace to healthy plants around and to healthy crops in the neighbourhood, infection being spread in the field by insects such as green aphis.

cases the lower leaves fall, leaving only a tuft at the top and giving the plant a palm-like appearance. The yield is affected very adversely.

Spindle-sprout.—Tubers which develop thin weak sprouts should be discarded. The plants which grow from such tubers are at best weak and unproductive. Rogueing in this case is effected also at planting-time, and the sprouting of the seed is a great advantage in this direction.

Other Diseases of Importance.

Although virus diseases are the most important, there are others that must be taken into consideration. Some of these are carried over in the tubers and affect the growing crop, others are storage diseases. All are of importance in that they reduce the quality of the seed and affect the subsequent crop, either in quality or quantity of produce. The grower of certified seed must adhere rigidly to the practice of marketing only absolutely sound seed. Even with the greatest of care odd damaged or diseased tubers get by, and under suitable conditions may set up serious trouble

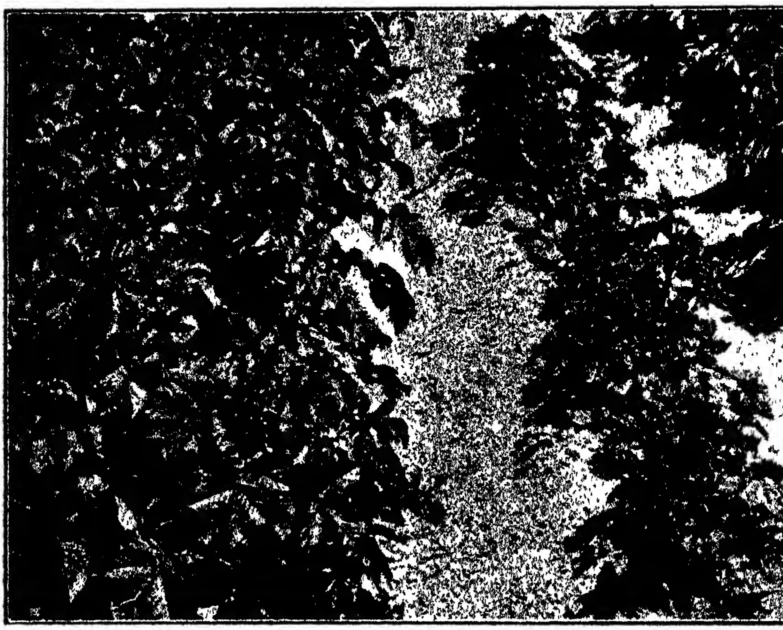

FIG. 4. SINGLE-PLANT SELECTIONS OF HEALTHY AND OF VIRUS-INFECTED ARRAN CHIEF.

During the growing season of 1926–27 some healthy and virus-infected plants were marked. The produce of each plant was kept separate and planted during the 1927–28 season. The photo shows the growth during the latter season of this one healthy and one virus-infected selection This demonstrates very clearly the transmission of virus disease from one season to another by means of the seed tubers.

in a line. In districts where late blight is prevalent spraying the crop with Bordeaux mixture should be adopted and the tubers subjected to a vigorous inspection, as this disease may develop and spread with disastrous results in storage. Great care should be exercised in digging and handling. Spores of the well-known storage disease "dry rot" are always present and gain entry through any fork marks or bruises, setting up the rot, which may be responsible for serious losses before the seed is planted. Eelworm and powdery scab can be seen on the surface of the potatoes, and

any tubers showing symptoms of these should be discarded, as under favourable conditions they may infect the subsequent crop, and in any case carry infection to the soil in which they are planted. Precautions should be taken against the potato-moth. Thorough moulding of the crop is the best preventive. Infected tubers should not be put into storage, as the pest may increase, causing serious damage to the whole line.

Other diseases likely to be encountered are wilts, mattery eye, and blackleg. These cause the upper leaves to become rolled and flaccid, generally commencing with one stem. Later the whole plant may wilt and die down long before the healthy plants. Discoloration of the flesh of the potato, more especially near the vascular tissue of the stem end, frequently is associated with one or more of these troubles. In some crops infection is too high for rogueing to be practicable, but in the seed-plot all plants showing these symptoms should be dug at once and the haulms and tubers removed.

Emphasis must be laid upon careful handling of the seed and thorough inspection of the tubers. Several cases have come under notice where apparently sound seed has developed storage rots after it has been subjected to warm humid conditions favourable to the development of such diseases. What might happen when seed has been handled carelessly or damaged tubers allowed to pass in a line is therefore evident.

The Seed-plot.

To rogue efficiently a large area of potatoes takes time and labour. To buy fresh supplies of "mother seed" at frequent intervals is costly. The regular grower of certified seed is therefore advised to plant a seed-plot to supply his own requirements. Using his purchased line as foundation stock he should go through his crop about flowering-time and mark with sticks a large number of healthy plants which have also healthy neighbours. These marked plants should be examined periodically during the remainder of the growing-season, and the stick removed if any doubts arise regarding the health of the plant. It should be kept in mind that bolters, being more vigorous and disease-resistant than the rest of the crop, are likely to appear promising, and should be avoided.

As the greatest spread of virus takes place later in the season, the marked plants should be dug in an immature state, as soon as good seed-sized tubers are formed. When digging, a standard should be set, say 6 to 8 tubers of average size per root, and any plants falling short of this should be rejected. The seed should be "greened" and stored under the best conditions available, in shallow trays if possible. By this means sufficient seed could be procured for the planting of a seed-production plot.

This plot should be isolated from all other potatoes, on land that has not grown potatoes for several years. The importance of isolation cannot be overstressed. Probably the *worst* location would be a few rows down the centre of the main crop, where it would be liable to infection from all sides. Two varieties should not be grown side by side. It has been proved that certain

varieties carry virus in a masked form and, while exhibiting no outward symptoms whatever, are yet a possible source of infection to another variety. Once established, the seed-plot should be rogued carefully.

This method is probably the most effective for the practical grower. It is systematic and based on sound principles, and at the same time avoids the disadvantages of the tuber-unit-selection or the hill-selection methods, which are slow and involve a large amount of detail and labour.

Cultural Operations and the Use of Fertilizer.

Experience has shown farmers generally the most satisfactory cultural methods for the crop in their particular district. There are one or two points, however, worthy of special mention. A large number of experiments carried out over a wide range of conditions has proved definitely that the judicious use of artificial manures is profitable. As a result of these trials the following recommendations are made :—

(1) On the lighter to medium-class potato soil use up to 3 cwt. superphosphate per acre. On the rich alluvial potato soils use up to 5 cwt. superphosphate per acre.

(2) Use 1 cwt. sulphate of ammonia per acre in addition to the superphosphate recommended above on all soils.

(3) Experiments indicate that 1 cwt. sulphate of potash, in addition to superphosphate and sulphate of ammonia, is likely to be profitable if used in districts represented by the following centres: Kirwee, Mitcham, Temuka, Taieri, McNab, and Gore. Until further information is available, potash is worth a trial as an addition to superphosphate and sulphate of ammonia on a small scale in districts not mentioned above.

(4) Where mechanical means of distributing fertilizers are not available, hand-distribution should certainly be carried out, either by sowing from a bucket or by using some knapsack-type of hand-distributor, such as those used for hill-country top-dressing.

(5) When the fertilizer is being applied by hand it should be spread in a strip about 3 in. to 4 in. wide along the bottom of the furrow in which the potatoes are to be planted. Confining the manure to a narrow strip is likely to render it more efficient than broadcasting it over the whole width of the furrow. Contact with fertilizers used at the rates recommended is not likely to damage the sprouting of the potatoes so long as the manure is spread before the potatoes are planted. If, however, cut seed is used it would be advisable not to allow the manure to come too freely in contact with the potatoes.

For the early potato crop in the Pukekohe district special conditions prevail. Recommendations based on trials in this district are as follows :—

(1) Use 8 cwt. to 11 cwt. of superphosphate and 4 cwt. to 6 cwt. sulphate of ammonia.

(2) Although it has been the regular practice to use potash on the early crop, trials have shown that it is of little value so far as its effect on yield is concerned.

To prevent increased acidity growers using sulphate of ammonia certainly should lime their land after the potato-cropping is completed in the rotation. About 1½ cwt. of ordinary ground limestone is required for every hundredweight of sulphate of ammonia used.

Weed-growth should be kept down in the growing crop. Weeds rob the crop and at the same time make rogueing difficult. Frequent harrowings across the rows until the plants are even 6 in. to 9 in. high, combined with the use of the horse-hoe between the rows, keeps weeds well under control.

Thorough moulding is essential to reduce the attack of the potato-moth and also to check spores of late blight from being washed down to the tubers. The mould should be brought to a narrow top. A wide or hollow top is almost useless.

If a digger is employed, ample soil should be brought up to have a cushioning effect on the potatoes. Tubers are often undamaged by the shoe, but may be badly bruised on the apron through not bringing up sufficient soil with them.

HANDLING OF SEED.

The greening and sprouting of the seed is an important matter. This should be carried out wherever possible by spreading the seed out in a shallow layer in subdued daylight. Reference to the advantages of adopting this measure has already been made under the headings of rogueing for foreign varieties and for spindle sprout. Additional advantages are an earlier "germination," and a much more vigorous and even stand; any tubers not sprouting or showing weak sprouts should be discarded. Allowing the tubers to make long spindly sprouts and then rubbing these sprouts off definitely weakens the tuber and affects the subsequent growth. Experience has shown that greened and sprouted tubers can be cut with less danger of missing than can unsprouted seed.

The practice of cutting table-sized tubers into setts for planting is one to be recommended when the market price of table tubers is low. An improvement in the general standard may be effected in this way because large tubers are likely to be the produce of relatively healthy plants, while seed-sized tubers may be, and very often are, the produce of poorly-productive diseased plants. Care has to be taken, however, in the handling of cut seed. Some varieties, notably Auckland Short Top, Auckland Tall Top, Majestic, and King Edward, will not stand cutting as well as others. In these cases particularly strict attention should be paid to the handling of cut seed. The safest precaution is not to permit the cut surface to dry. Even exposure for half an hour may be disastrous, and the setts should be planted in moist soil and covered at once. Covering the setts with wet sacks, and even handling them in wet sacks during planting, are wise precautions. It is advisable not to cut large quantities, but to cut as required. If, however, they have to be stored they should be spread out to avoid any danger of "sweating" and kept moist with a covering of wet sacks.

VARIETIES.

Although many varieties of potatoes are grown in New Zealand only about a dozen are of real commercial importance. The following table, compiled from entries received for certification, indicates the popularity of the more common New Zealand varieties.

Potato Certification: Acreage provisionally certified.

Variety.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.
Auckland Short Top ..	96	298	352	238	357
Dakota	132	270	145	146	261
Auckland Tall Top ..	56	86	92	53	42
Arran Chief	6	18	26	58	164
King Edward	25	30	21	27	25
Up-to-Date	3	11	22	11	9
Epicure	29	56	31	14	9
Iron Duke	12	23	7	9	22
Bresee's Prolific	78	107	31	33	10
Arran Banner	..	..	3	18	60
Early Regent Bolter ..	..	..	1	6	16

For a general all-round variety combining moderate earliness with cropping ability and quality, Auckland Short Top is deservedly the most popular. Unfortunately this variety has a particularly thin skin and bruises easily in handling. For the lighter warm soils of Canterbury Dakota gives satisfactory results, and has in addition the merits of being a splendid keeping and cooking variety. Arran Banner is an excellent cropping variety, but unfortunately has been grown extensively on the heavy soils, where it develops very large tubers, very deep in the crown end. It should be grown on the medium potato land. For the very rich land Iron Duke is probably the heaviest cropper. As, however, this variety is very late, it should not be grown on land subject to water-logging in the late autumn. In the southern districts King Edward does very well as a second early. Arran Chief is the most popular main-crop variety in those parts, and in fact is well suited to any heavy potato-land, particularly in the colder localities. Bresee's Prolific has been grown extensively on the light, dry soils, but is losing its popularity on account of its susceptibility to brown fleck. Aucklander Tall Top is also waning in popularity on account of its very late maturity and tender skin. In the Pukekohe district the Northern Star variety is practically the only one grown, and this is chiefly on account of its ability to produce a second crop from seed dug the same season.

Acknowledgments.

Acknowledgments are made to the following: J. W. Hadfield, Agronomist, for assistance and co-operation in preparing and revising this article; J. H. Claridge, Assistant in Agronomy, for the tables in connection with seed-certification; A. W. Hudson, Crop Experimentalist, for the particulars dealing with manuring and other assistance; J. C. Bell, Instructor in Agriculture, for particulars dealing with manuring in the Pukekohe district.

Part II will deal with varieties, their description and economic value.

The club-root organism was isolated from soil not previously in brassicas for four years and a half, and found to be pathogenic.—*Report, Mycologist.*

LIVE-STOCK POISONING IN NEW ZEALAND.

B. C. ASTON, Chief Chemist, Department of Agriculture.

(Continued from January, 1935, Journal.)

EFFECT OF INDIGENOUS PLANT POISONS ON ANIMALS.

THE family to which tutu belongs, *Coriariaceae*, is one which contains the single genus *Coriaria*, comprising some ten or a dozen closely related species scattered over the world, mostly in alpine or sub-alpine situations, in New Zealand, Mexico, the Andes, Japan, China, the Himalayas, North Africa, and South Europe, a very curious distribution. From the European species *C. myrtifolia*, "redoul," which was first investigated by Riban in 1863, the crystalline poisonous principle coriamyrtin was isolated. This is similar in its physiological action to tutin, but more toxic. In recent years two Japanese chemists, Kariyone and Sato (*Jour. Pharm. Soc.*, Japan, Feb., 1930), have isolated both these principles from the Japanese species (*C. japonica*). Although so closely related to one another, the species seem to vary greatly in their relative effects on animal life. The European species is highly toxic to higher life, and persons have been poisoned in France from drinking senna tea made from senna leaves adulterated with *Coriaria* leaves. Snails fattened on the leaves of the redoul, although themselves apparently unaffected, poisoned several persons who ate the snails at Toulouse, France. On the other hand, green beetles fed on the leaves of the New Zealand plant *C. ruscifolia* failed to poison a fowl when it was fed on the beetles. That birds are little susceptible to some vegetable poisons has already been shown in the case of domestic fowls and pigeons dosed with tutin. It is also reported that the flesh of the Argus pheasant of Malaya is poisonous owing to the poisonous nature of its vegetable food, the bird itself being unaffected. The Himalayan species, *C. nepalense*, is a staple food for the herds of animals in Nepal, and the herdsmen eat large quantities of the fruit without ill effect. The seeds of the New Zealand species are undoubtedly poisonous, but if these seeds are strained off the pulp surrounding them the pulp is not only innocous but was highly esteemed by the Maoris as furnishing an agreeable drink.

It will be convenient here to consider in some detail the manner in which New Zealand poisonous plants affect domestic stock, and the methods which have been adopted or suggested for treating an animal which is suffering from eating a poisonous plant when the identity of that plant is known or strongly suspected.

There are three distinct stages in the investigation of poisonous plants: The first, when, owing to the accumulation of a number of facts by farmers and other observers, a plant becomes suspected of being a potential danger to stock. The second is when the plant is fed and found to produce poisoning symptoms in some test animal corresponding with the symptoms found in the field under natural conditions. The third is where the chemist separates either a substance in which the active principle is concentrated or

a substance which may be the principle itself in a more or less pure state. By giving minute doses of the concentrate or the principle to an animal the same symptoms are produced that result from the eating in large quantities of the plant itself. An example of the concentrated extract is the resinous matter which alcohol dissolves from *Pimelia* (Strathmore weed), the bark of which is poisonous to guinea-pigs (see Leaflet to Farmers No. 55, issued in 1900, or p. 311, 1900 Rept. of the N.Z. Dept. of Agric.). The value of the last method, at its best, is that the true action of the pure active principle may be obtained unclouded by the action of other compounds which may exert a distinct effect on the animal. The pure principle may also be injected directly into the blood system of the animal instead of having to be absorbed through the digestive system as when the plant is given by the mouth, and this method of injection usually is preferred by physiologists as being the more reliable. The isolation of the pure active principle is, however, often a matter of great difficulty to the chemist, but when it is accomplished the interest of pharmacologists is aroused, and they give their attention with enthusiasm to the discovery of the exact way the animal reacts when dosed with the principle.

Generally speaking, tutin, the crystalline active principle of all the three New Zealand species of the tutu plant, is rapidly fatal to all kinds of life. Fitchett and Malcolm proved that tutin was poisonous to cats, rabbits, guinea-pigs, pigeons, lizards, frogs, fishes, insects (house and blow flies), larvæ (blowfly maggots), shellfish (molluscs and cockles), *Infusoria* and *Amoebae*. On some bacteria, but not all, tutin had a deleterious action, but did not have any effect on yeast cells, which caused vigorous fermentation in glucose, even when 0·4 per cent. of tutin was present in the solution. With regard to the response of larger animals, no results of any ill-effect of tutin on ruminants or horses appear to have been published. There is some doubt if horses have ever been poisoned by the plant, Laing and Blackwell ("Plants of New Zealand," 1906, p. 228) state that horses have been known to eat freely of this plant without evil effects. Featon ("Art Album of New Zealand," p. 104), however, a non-scientific writer, states that it is generally asserted that horses will not eat the tutu, but had evidently heard some opinions to the contrary. Haast (*Trans. N.Z. Inst.*, Vol. 2, p. 299) describes the death of an elephant attached to a travelling menagerie in Otago, which, after feeding on herbage containing tutu for four hours and drinking a long drink from a creek, fell to the ground and died three hours later. Haast thought it remarkable that the elephant should, like cattle and sheep, eat the plant while horses will not touch it; but from the author's own knowledge there is no doubt that horses do eat tutu in moderation. It is noteworthy that the first animal to be experimented upon with the active principle was a pig. Dr. Gilruth has recorded the details in dosing a pig weighing 35 lb. with two grains of tutin, which was fatal to the pig in five hours (p. 142, 1900 Rept. of the N.Z. Dept. of Agric.).

Different animals are susceptible to tutu in different degrees according to the species. Fitchett and Malcolm found the minimal lethal dose was as follows, expressed in milligrams (1 mm. equals $\frac{1}{65}$ grain) of tutin per kilo (2·2 lb.) of animal body-weight: cats

0·75, guinea-pigs 2·0, rabbits 2·5, lizards 3 to 4, birds 10·5—all by administration by the mouth; frogs 10·5—given hypodermically; fishes 50·0—when immersed in the solution. The smallest dose which was certain to kill a medium-sized rabbit was found to be 2·5 mm. ($\frac{1}{28}$ grain). It was found that birds could withstand very large doses—10 milligrams per kilo of tutin administered by mouth. Attempts to poison a common fowl and a pigeon with the "berries" and dried seeds of tutu failed, and the author doubts if birds can be poisoned by eating berries, owing to the large quantity that would have to be eaten. Easterfield and Aston (*Trans. N.Z. Inst.*, Vol. 33, p. 346, 1900) reported that fowls had been affected by the seed (freed from the pulp). In their article, however, the word "berries" was inadvertently used instead of seeds. These authors found the highest amount of tutin in the plant to be 0·03 per cent., which was present in the young shoots. Fitchett and Malcolm state that tutin does not appear to be destroyed readily in the body or excreted, for it was found that medium doses given to a guinea-pig every second day caused death after the fifth dose. This suggests that stock may be poisoned by eating moderate quantities of tutu day by day, the poison accumulating until enough is present in the blood and tissues to cause the symptoms to appear. The question of acquired tolerance was also investigated by those authors, but no determinate conclusion was reached, although the evidence seemed to indicate that tolerance may be established in a high degree in animals which ingest small quantities of tutin over long periods.

Treatment of Poisoned Stock.

The method of treatment of stock when poisoned by specific poisonous plants is a wide field, and one on which the veterinarian who has made *Materia Medica* a study is best able to give advice.

Those who would like to examine the findings of Professors of Pharmacology should read the researches of Dr. C. R. Marshall in *Trans. of Royal Society of Edinburgh*, Vol. 47, pp. 286–316, 1910, abstracted in the proceedings of *N.Z. Inst.*, 1911, page 27. There the pharmacological action of the pure crystalline active principle of tutu, called by chemists "tutin," is set forth.

The same authority, in the 1905 Rept. of the N.Z. Dept. of Agric., p. 79, has given practical advice on the treatment of the stock poisoned by the tutu plant as follows: He had found no antidote for tutu poisoning, and doubted if any true antidote would be found. For animals, the best treatment if they will lie still is to leave them alone. An animal will recover from large doses of tutu if it will remain quiescent, but unfortunately they develop a tendency to run about. Bleeding is certainly very beneficial, and if animals show any tendency towards convulsions it is best to bleed them and inject a small amount of chloral-hydrate in a large volume of 0·8 per cent. common salt solution. Dr. Marshall also gave some valuable information as to the treatment of children suffering from tutu poisoning, which was communicated to the Health Department.

Later physiological investigators were Dr. Fitchett and Professor Malcolm, working in conjunction in Dunedin, and their results are

summarized in the annual report of the Department, 1908, p. 221. In the main they confirm the previous advice given by Dr. C. R. Marshall—that is, the administration of chloral and bleeding. For the treatment of stock they recommend the administration of lime-water and preferably the stronger "liquor calcis saccharatus" of the British Pharmocopœia. The use of the stomach tube where possible would not only render the administration easier, but might also allow of the escape of the gases which accumulate in the stomach in most cases. There is a distinct value in the suggestion that "tuted" animals should be disturbed as little as possible. They believe that once convulsions are initiated a vicious cycle is established—convulsions beget convulsions.

In the *N.Z. Journal of Agriculture*, 1917, Vol. 15, page 307, Mr. A. R. Young, M.R.C.V.S., then Director of the Live-stock Division, gives the following practical directions for stock poisoned by the tutu plant :—

All the information in our possession at the present stage warrants us in dividing, for all practical purposes, tutu poisoning into three degrees of severity :—

(1) When the animal has consumed a large amount of tutu, in which case there is no cure ; (2) when the amount of tutu eaten is not sufficient to cause rapid developments, in which case cures should be tried, and may be successful ; (3) when tutu has been eaten in small quantities (as is common) and the animals recover of their own accord, and then soon acquire a certain amount of tolerance to the effect of the plant

As to treatment, it may be stated in the first instance that nearly every stockowner or drover has his own absolute cure, which is usually promptly condemned by others who try it However, taking the action and symptoms induced by the poison, I would place treatment in the following order : Bleeding from the neck, or if the animal possesses horns these should be sawn off close to the head. This will allow of sufficient bleeding. Administer also (if this can be done) a dose of Epsom salts to clear out as much of the poison as possible, and when the animal, as is generally the case, gets "blown" introduce a probang through the mouth right into the stomach, then withdraw the stiletto and allow the gas to escape. Before withdrawing the probang a funnel can be placed in it, and small quantities of medicine introduced right into the stomach, thereby avoiding the risk of choking. A quantity of lime-water, a cupful or more of a solution of ammonium bromide and potassium bromide, 2 drams of each, dissolved in the water, or 2 drams of chloral hydrate in the same quantity of water, may do a great deal of good.

When there is much excitement and it is dangerous to drench, hypodermic injections can be used, such as 2 grains of arecolin followed by the trochar and cannula. This instrument is introduced into the large stomach by plunging it into the left flank, taking as a guide about a hand-span from the last rib, the wings of the spine, and the haunch-bone. Afterwards withdraw the trochar, and leave in the cannula, through which the gas will escape.

Many cases will be found, however, where energetic treatment must be at once adopted, and little time is allowed to secure instruments or drugs. In such cases a sharp pocket-knife will draw blood, and can also be used instead of a trochar and cannula, the finger or neck of a bottle being used to keep the wound open. A larger opening at this spot could be made and the whole of the contents of the stomach removed, but this requires considerable experience, as care must be taken that no fluid or other material is allowed to escape into the abdominal cavity. The stomach, as also the flank, requires to be stitched up afterwards, and the animal kept on a low diet for a few days.

It may be mentioned that a cow heavy in calf is apt to slip it if she has eaten sufficient tutu to cause convulsions or hoven, but should the poison not so act at the time and the fœtus live, there should be no interference with natural calving.

It is remarkable that poisoning of animals by tutu seems to have a permanent injurious after-effect on the nervous system of the animal, persisting even after the animal has apparently recovered from the grosser results of the poisoning. The writer has been assured by a Taupo farmer that sheep that have been "tuted" never associate with their fellows again, but follow a solitary existence. In Elwell's "Boy Colonists," published in 1878, p. 34, it is recorded that sheep seldom thoroughly recover after tutu poisoning; they are generally apparently affected in the brain by it, for they wander along after its physical effects have passed away and nothing will induce them to join their fellows.

Four cases of loss of memory in human beings are quoted by Christie (*N.Z. Medical Journal*, No. 4, Vol. 3, July, 1890) as a result of eating tutu berries. Fitchett (*Trans. N.Z. Inst.*, p. 290, Vol. 41, 1908) adds others, in one of which mental change occurred which was permanent after the acute symptoms had subsided. A writer to the *Otago Witness*, 7th February, 1928, confirms this loss of memory in "tuted" victims, recording that one suffered from a mild form of St. Vitus's dance ever since the poisoning.

Dr. Lauder Lindsay also records similar effects in humans. Fitchett remarks that loss of memory appears to occur also in the lower animals, for shepherds have observed that a "tuted" lamb which has recovered does not know its own mother, and the ewe may be seen following her lamb and striving to excite recognition.

With regard to the curative treatment for plants other than tutu, it has been seen that brisk exercise is the bushman's remedy in cases of poisoning of horses by rangiora (*Brachyglottis*), and in cases of bracken fern, which is a slowly acting poison, the obvious remedy of removing stock to a paddock where no fern is obtainable is successful—this *Journal* (Vol. 1, p. 215, 1910), where a case of poisoning is described by Hickman, M.R.C.V.S. The above advice for fern poisoning is repeated in this *Journal* for February, 1926, page 139, by the Live-stock Division, in answer to a correspondent, where it is recommended to supplement the actual pasture food by a few handfuls of linseed nuts and bran daily until the condition of the animals shows general improvement, and also to give each affected animal 12 oz. of Epsom salts and one tablespoonful of ginger in a quart of oatmeal gruel, sweetened with molasses.

For *Pimelia* (Strathmore weed), Webster, M.R.C.V.S. (*Journal*, 1926, p. 104), in the treatment of horses, recommends "a stimulant and purgative dose of linseed oil in the first instance, followed by linseed-tea, bismuthi carb., and strong coffee in liberal doses at four-hour intervals."

For ngaio poisoning in cattle, Webster (*N.Z. Jour. Agric.*, August, 1926, p. 105) states that from its characteristics the administration of demulcents and stimulants appears indicated.

(To be continued.)

The Fields Instructor, Greymouth, reports that *Poa aquatica*, introduced a few years ago by planting a few roots, has spread through wet swamp at Waitaua, and produces much feed which stock eat greedily and on which they winter well.

PAMPAS GRASS AND ITS IDENTIFICATION.

H. H. ALLAN and V. D. ZOTOV, Plant Research Station, Palmerston North.

SINCE the publication in this *Journal* (October, 1932, May, 1934) of articles by Mr. B. C. Aston on pampas grass as winter cow-feed, we have received numerous specimens from various localities with the inquiry whether they were specimens of pampas grass or not. In view of the economic importance of the grass it seems worth while giving a few details of its characteristic features, and of others likely to be confused with it—toetoe and Cunningham's danthonia.

In the flowering stage these grasses are easily distinguished after a little careful examination. A glance at a flower-cluster of Cunningham's danthonia (fig. 1) will show the features necessary

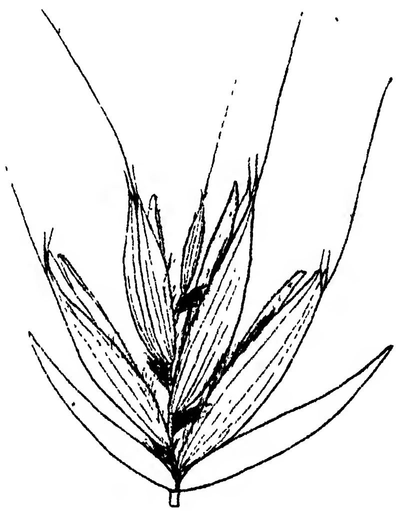

FIG. 1. SPIKELET OF CUNNINGHAM'S DANTHONIA, SHOWING THE PARTS MENTIONED IN THE TEXT.

for comparison. The whole cluster (spikelet) has at the base two empty delicate husks (glumes). Above these are the florets, each on a short stalk (rachilla). In the drawing are shown four florets, surmounted by an imperfectly developed one, the spikelet being somewhat spread out to show the parts more clearly. The essential parts of each floret are enclosed between two husks. The larger outer one (lemma) enfolds the inner more delicate one (palea). In Cunningham's danthonia the lemma ends in two fine teeth, from between which extends a long slender bristle (awn). At the approach of flowering the upper portion of the palea is pushed out from the lemma and is seen to be sharply folded at each margin. The essential parts (male and female elements) are thus exposed to view. In Cunningham's danthonia (fig. 2) each floret contains both elements. The ovary (later ripening to form

the grain) is surmounted by two stalks (styles) each bearing a feathery pollen-catching apparatus (stigma). The male element consists of three stamens. A stamen consists of a stalk or filament carrying the pollen-containing anther. The figure shows an early stage of development, and for clearness only the filament of the front stamen is shown.

With these points in mind the following key, along with the fuller descriptions given later, should enable any one to distinguish the three grasses here discussed.

1. Florets *not* obscured by very long hairs——2.
   Florets obscured by very long hairs——3.
2. Florets with both male and female elements (figs. 1, 2, 4)——*Danthonia Cunninghamii.*
   Florets containing male elements (stamens) only (fig. 3, d, e, f)——*Cortaderia argentea.*
3. Florets containing both male and female elements fully developed (fig. 5)——*Arundo conspicua.*

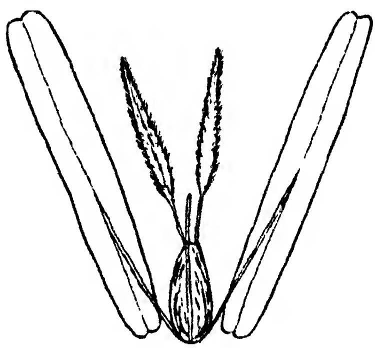

FIG. 2 FLORET OF CUNNINGHAM'S DANTHONIA, WITH THE HUSKS REMOVED.
(See also No. 3 and No. 8 in Fig. 4.)

Florets containing only female elements fully developed (imperfectly developed stamens may be present) (fig. 3, a, b, c)——*Cortaderia argentea.*

All three plants form exceptionally large tussocks, with long coarse leaves and large inflorescences.

In the absence of flowers the three species may readily be distinguished by a careful examination of the leaf-structure. The leaf of a grass is in two main portions, a sheath clasping the stem, and a blade free from it. At the junction of the blade and the sheath there is usually a band somewhat differently coloured from the rest of the leaf (the collar), and on the inner face at the junction is also a structure known as the ligule. In our three grasses the ligule is a line of densely placed short hairs and does not serve as a good differentiating mark. But the arrangement of the veins is very distinct, as shown in the following key:—

1. Prominent stout veins run parallel to the midrib in both sheath and blade (fig. 6, b, e)——*Arundo conspicua.*
   No prominent stout veins parallel to midrib——2.

2. Sheath rounded, not showing a prominent midrib, but with numerous short cross veinlets (fig. 6, a, d)——*Cortaderia argentea*.

   Sheaths showing a prominent midrib, about which it is flattened; cross veinlets not clearly visible (fig. 6, e, f)——*Danthonia Cunninghamii*.

Pampas Grass.

The leaves of pampas grass (*Cortaderia argentea*) reach a length of 5 ft. or more, the lower part of the blade is erect; the upper

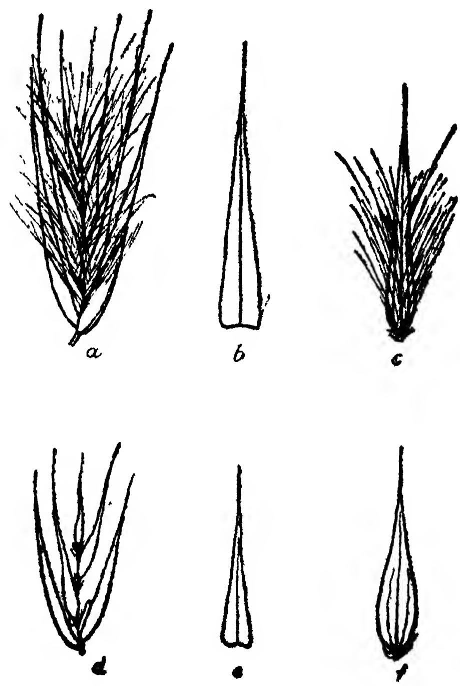

FIG. 7. PAMPAS GRASS.

(*a*) Female spikelet, (*b*) glume of female spikelet (*c*) lemma of female floret; (*d*) male spikelet; (*e*) glume o male spikelet; (*f*) lemma of male spikelet.

part turned through an angle of 180 degrees. The sheaths are pale and somewhat brittle, with numerous fine veins connected by short cross veinlets, clearly visible when a portion of the sheath is held to the light. The broad midrib of the blade does not extend into the sheath. Above the ligule on the inner face there is a hairy portion, but this is much less developed than that found in toetoe. The blade is wider than that of toetoe, with numerous fine veins parallel to the midrib, but no development of especially stout lateral veins as in toetoe. On cutting across the sheath large air-spaces will be noted. The flower-stems are stout, solid, from 6 ft. to 10 ft. high, with erect feathery, silvery white or pinkish plumes, from 1 ft. to 3 ft. high, of densely placed spikelets. Each spikelet

FIG. 4. CUNNINGHAM'S DANTHONIA, FROM BUCHANAN'S "GRASSES OF NEW ZEALAND."

(fig. 3, a, d) has two to three florets. On the female plants these florets (fig. 3, c) are clothed in long silky hairs, obscuring the lemmas, which terminate in a fine awn (not arising from between teeth as in toetoe and Cunningham's danthonia). The male florets (fig. 3, f) lack the long silky hairs, and the white or brownish papery lemmas are clearly visible. The awn is as in the female floret.

Pampas grass is a native of the country from Southern Brazil to Northern Argentina. It has long been known and grown as an ornamental grass. In America it is cultivated rather extensively, the plumes of the female plant finding a ready market in London, Berlin, New York, and other large cities. The forage aspect has been fully dealt with in Mr. Aston's articles. The huge tussocks, with their densely crowded leaves, form a striking feature in landscape gardening, especially when in flower. It appears to have been first called "pampas grass" in Paxton's "Flower Garden" of 1850, but in its native haunts, *Cortaderia argentea* is practically confined to watercourses, and to depressions where there is a constant supply of moisture. It is absent from the great grass areas known as the "Pampas," so that the name is hardly appropriate, though now thoroughly established.

In New Zealand it has been much used as an ornamental grass, and has in odd localities become more or less naturalized. It appears to be a shy seeder with us, partly owing to the sexes being on separate plants, so that a plantation increased by vegetative means may be all of one sex. As the female plant is much the more handsome there are many more plants of this sex than of the male in gardens. I have no information whether one or the other sex is more favoured by stock, but certain strains may be more succulent than others.

TOETOE.

Toetoe (*Arundo-conspicua*), a graceful indigenous grass, also forms huge tussocks, almost rivalling those of pampas grass. The leaves are almost as long, rather narrower, more finely toothed on the margins. The strong, straw-coloured side nerves form a very marked differential feature (in some forms the midrib and larger side nerves are distinctly reddened). The sheaths are also nerved and much tougher than those of pampas grass, while the air spaces are smaller. The sheaths, too, when young, are covered by a bluish "bloom" absent in pampas grass. The flower-stems are up to 10 ft high, more slender than those of pampas grass; the plume is from 1 ft. to 2 ft. long, rather less dense, and usually somewhat nodding and of a yellowish to brownish tinge. This brownish tinge is more developed in the very closely related species *Arundo fulvida*. The teeth of the lemma are prolonged into awns (fig. 5, 5).

This grass is distributed throughout New Zealand, often in large colonies. It favours swampy and damp ground, river-banks, and channels in the hillside. In some places it is also abundant on sand-dunes. Stock do not greatly like the plant as it grows, but it has been found to be more or less readily eaten when cut or chaffed. In a small hillside paddock near Feilding, containing much toetoe and

FIG. 5. TOETOE, FROM BUCHANAN'S "GRASSES OF NEW ZEALAND."

some pampas grass, a few cattle were recently turned in. In a day or two the pampas grass was eaten to the ground, but the toetoe was hardly touched.

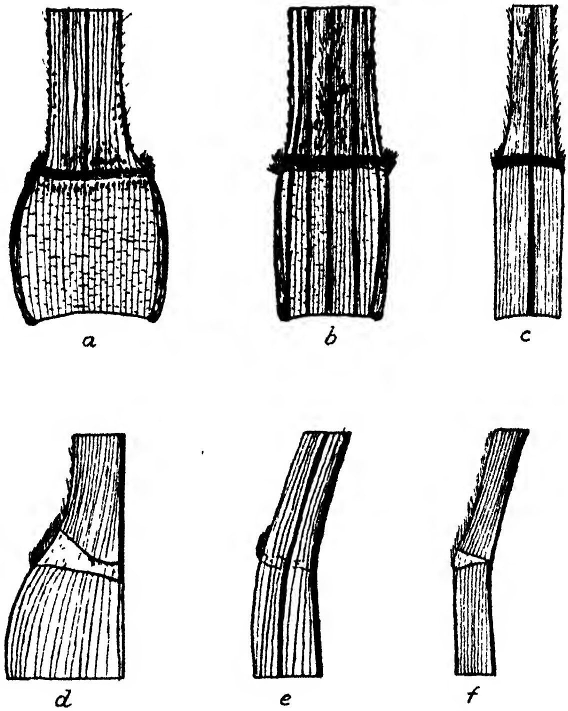

FIG 6 JUNCTION OF BLADE AND SHEATH.
(a, d) Pampas grass, (b, e) toetoe, (c, f) Cunningham's danthonia.

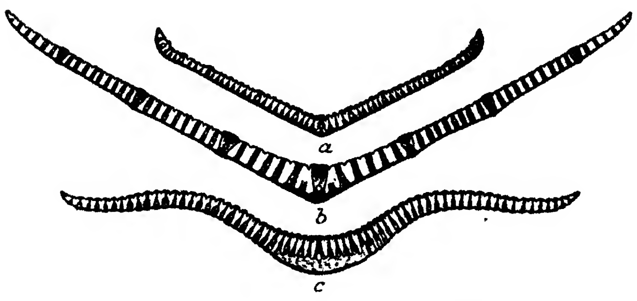

FIG. 7. CROSS-SECTIONS OF LEAF-BLADES.
(a) Cunningham's danthonia; (b) toetoe; (c) pampas grass.

Cunningham's Danthonia.

Cunningham's danthonia (*Danthonia Cunninghamii*) is another handsome indigenous grass. It does not as a rule form such large tussocks as the other two species, though in certain river valleys in North-west Nelson stately examples may be met with. The leaves are from 1 ft. to 5 ft. long, much narrower than in the other two species. There

is a much sparser development of hairs near the ligule than in toetoe, and the blades and sheaths lack the stringy side veins of that species. There are usually scattered hairs on the margins of the blade in the lower portion, and the teeth are very fine. The flower-stems are from 2 ft. to 5 ft. tall, the plume about 1 ft. high as a rule, but occasionally much larger, and much more open and spreading than in either pampas grass or toetoe, the spikelets standing apart on long slender stalks. The spikelets bear from three to seven flowers, and the hairs on the lemmas are short (fig. 4, 2), not concealing them.

This species is found through both Islands, but is absent from many areas. It is usually a montane grass, but in the South Island may be found along streams at low levels. Cattle and horses are fond of the plumes when these are in the early flowering stages.

For those possessing a lens and a sharp knife the shape and appearance of the cross-section of the blades will furnish a further means of distinguishing these grasses. Our sections (fig. 7) were taken from about the middle portion of representative blades Heavy lines and darkened areas represent tough fibrous tissue. In such sections the differences of the venation are very clearly seen.

APHIDES AFFECTING CULTIVATED PLANTS.

(2) THE APHIDES OF THE POTATO.

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IN New Zealand there are three species of aphides commonly found on potato-foliage. These are *Myzus persicae* Sulz., *M. pseudosolani* Theo., and *Macrosiphum gei* Koch. While these are the characteristic aphides of potato-foliage they are by no means confined to this plant, and, in fact, they appear, in New Zealand, to be the most widely distributed species of the family.

In this country, as a general rule, mechanical damage done to potato-foliage by the feeding of these insects does not seem to be important, since it is very seldom that plants are so badly infested that they are visibly affected. The damage is done, however, by the action of the aphides in transmitting potato-virus diseases—*e.g.*, leaf-roll—the aphis most concerned with this transmission being *Myzus persicae*.

Below, an attempt has been made to describe the appearance of these aphides, and to discuss their economic significance to the potato crop.

MYZUS PERSICAE Sulz.

This insect is the smallest of the three characteristic aphides of the potato.

The wingless viviparous female (fig. 1, c) is most commonly a whitish-green to dark green, but it also may be shades of yellow and pink. The pink forms seem to be somewhat localized, being found in groups in various localities and not generally distributed. This wingless form is usually 1·5 m.m. to 2 m.m. long and presents a somewhat flat appearance.

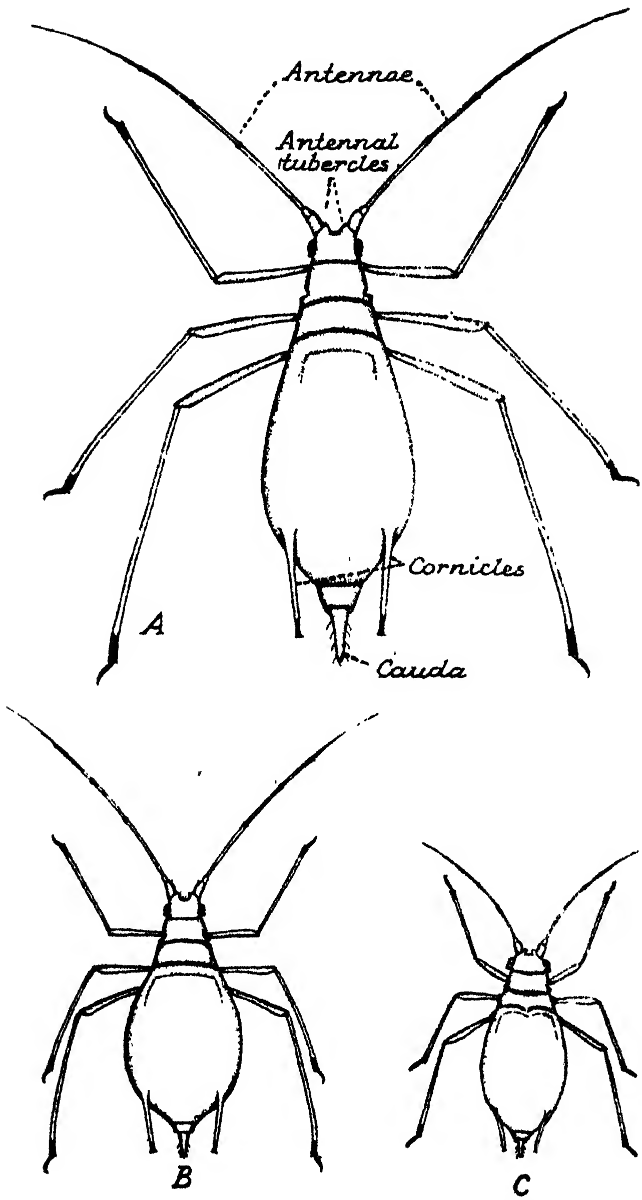

FIG. 1. WINGLESS VIVIPAROUS FEMALES OF—A, MACROSIPHUM GEI; B, MYZUS PSEUDOSOLANI; C, MYZUS PERSICAE. X 16 (approx.).

[Original.

The antennæ are slightly shorter than the body, the frontal tubercles project inwards and the cornicles are usually slightly swollen at or near the middle.

The winged viviparous female (fig. 2, C) has four wings, the front pair being much larger than the hind pair. The head and thorax are black, while the upper surface of the abdomen is greenish with black bands and has a large black patch in the centre. The cornicles are usually very dark and are swollen at or near the middle. The antennæ are approximately as long as the body. Length of the insect is 1.5 m.m. to 2 m.m.

HABITAT.

On the potato this insect is found on the undersides of the leaves and is fairly evenly distributed over the whole plant, but shows a preference for sheltered leaves such as those at the base.

NEW ZEALAND HOST-PLANTS.

M. persicae has been taken from the following plants: Potato, tomato, *Brassica* spp., peach, beet, green peas (*Pisum sativum*), docks (*Rumex* spp.), fat-hen (*Chenopodium album*), nightshade (*Solanum nigrum*), *Hebe* sp., Californian thistle (*Cirsium arvense*), *Daphne* sp., *Lilium* sp., *Chrysanthemum*, *Cineraria*, pansy, chickweed (*Cerastium vulgatum*), tobacco

In other countries this aphis hibernates in the egg stage on such woody plants as the peach and nectarine. On reading literature one gains the impression that this is the commonest form of hibernation, but in New Zealand the situation is not as simple as this. In the southern portion of the South Island *M. persicae* is a serious pest of peaches, and the winter is certainly passed on these trees in the egg stage. These eggs hatch in the following spring and the insects cause very serious damage by sucking the sap and curling up the peach leaves. However, while the writer was engaged in studying the host-relationship of this aphis in 1929 and 1930 it quickly became apparent that the aphis can readily pass through our winter without having recourse to the egg stage. Specimens of *M. persicae* can be found feeding on *Brassica* spp. at almost any period of the winter, and these serve as sources of infestation to potato-fields

MYZUS PSEUDOSOLANI Theo.

The wingless viviparous female (fig. 1, B) may be one of various shades of whitish-yellow, yellowish-green to deep green, the commonest colour being rather a bright green. That part of the abdomen posterior to the cornicles is usually shiny. On the abdomen, at the bases of the cornicles, are darker patches of what appear to be collections of oil globules. The antennæ are green. The cornicles are cylindrical, green, with their apices dusky. The cauda is about one-third the length of the cornicles. Length of insect 2 m.m. to 2·5 m.m. See the figure for the shape of the antennal tubercles.

The winged viviparous female (fig. 2, B) is green, with the head and thorax darkened. The abdomen is decorated with dark transverse bars, and four dark lateral spots on each side. The antennæ are as long as, or a little longer than, the body, and are darkened. The

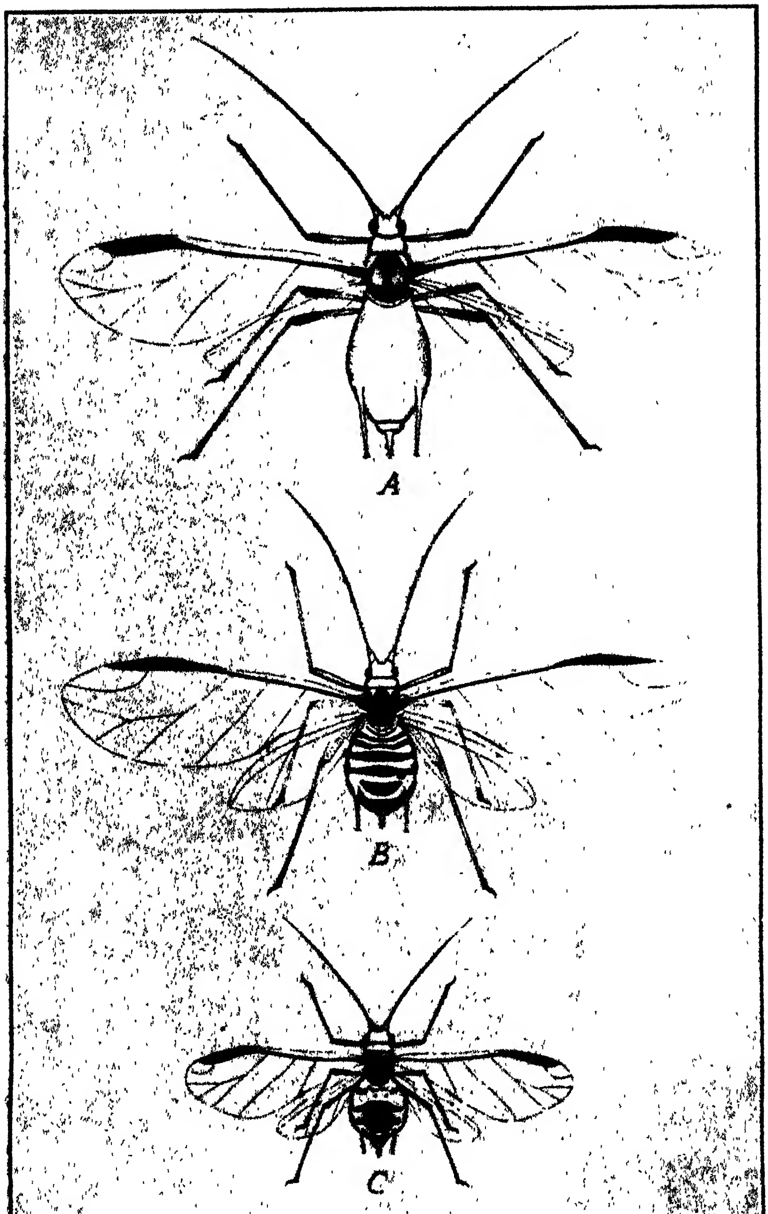

FIG. 2. WINGED VIVIPAROUS FEMALES OF—A, MACROSIPHUM GEI; B, MYZUS PSEUDOSOLANI; C, MYZUS PERSICAE. X 11 (approx.).

[Original.

cornicles are green and cylindrical, with the apices dusky. The cauda is green. Length of insect 2·3 m.m. to 2·5 m.m. The antennal tubercles are as in the figure.

HABITAT.

On the potato this insect shows a decided preference for the sheltered leaves near the ground. This habit is much more developed than in *M. persicae.*

HOST-PLANTS IN NEW ZEALAND.

The known host-plants of this aphis in New Zealand are: Potato, dock (*Rumex* spp.), foxglove (*Digitalis purpurea*), *Hydrangea* sp., *Abutilon* sp., buttercup, *Lychnis* sp., *Lilium* sp., chickweed (*Cerastium vulgatum*), poppy, *Geum* sp., *Buphthalmum* sp., pansy, nightshade (*Solanum nigrum*), *Coprosma grandifolia.*

In America, according to Miss E. M. Patch (1928), *M. pseudosolani* lays winter eggs on the foxglove (*Digitalis purpurea*). Although the insect has been found on foxglove in New Zealand, there is as yet no evidence gathered to prove that this form of hibernation is the rule in the Dominion. In Palmerston North the writer has frequently found the aphis breeding on the docks (*Rumex* spp.) in the middle of winter in fields which carried potatoes the preceding season. These particular aphides were of a light-yellowish colour. Also was this the case in Pukekohe in the North Island, where the early spring potatoes were just appearing above the surface of the ground among quite a number of docks. The aphis was abundant on the docks and was ready to move across to the potato-plants. This illustrates at least one method by which this insect can pass the winter.

MACROSIPHUM GEI Koch.

The wingless viviparous female (fig. 1 A) of this aphis is the largest of the species of this family on the potato, its average length being 2·8 m.m. to 4 m.m. The colour of the insect is green. The antennæ are usually longer than the body. The cauda is pale green, while the cornicles are large and green in colour, with their apices darkened. The cauda is about half the length of the cornicles. For the shape of the antennal tubercles see the figure.

The winged viviparous female (fig. 2. A) is usually green, with the head and thorax yellowish-green. The cornicles are cylindrical and green in colour, with their apices darkened. The antennæ are longer than the body. There are no marks on the abdomen. The average length of the insect is 2·9 m.m. to 3·3 m.m. For the shape of the antennal tubercles see the figure.

Young forms of this aphis usually have a light white mealy coating on the body, while all stages of the other two species are without this.

HABITAT.

On the potato this aphis much prefers the shelter of the lower leaves, where it may frequently be found in large numbers.

HOST-PLANTS IN NEW ZEALAND.

This aphis has been found on the following plants: Potato, tomato apple, *Solanum* sp. (a hedge plant), rose, lettuce, sow-thistle, hawthorn,

Abutilon sp., *Gladiolus* sp., *Tulipa* sp., fat-hen, *Brassica* spp., *Lychnis* sp., carnations and pinks, *Hebe* sp., nightshade (*Solanum nigrum*), Californian thistle, poppy, *Chrysanthemum*, *Cineraria*, *Cerastium vulgatum* (chickweed), strawberry, dock (*Rumex* spp.), buttercup.

This aphis appears abundantly on the young shoots of roses in the early spring, and it is also very common at this period on the young leaf-shoots of apples. Later it may be found on the potato and other of its hosts. Miss Patch (1915) states that in America it passes the winter in the egg stage on woody plants, the rose being the favourite. Although in New Zealand this aphis does appear first in numbers on the rose in the spring, which fact suggests over-wintering eggs, endeavours to find such eggs have failed up to the present. Another favourite host-plant is the sow-thistle (*Sonchus oleraceus*), and the writer has found the young succulent parts of these plants overcrowded with colonies of *M. gei* shortly after the potato crops have died off. The insect is still on the thistle at the middle and end of the winter, although in much reduced numbers.

It has also been found sparsely on such roses as ramblers in mid-winter. There is no doubt that the insect can pass the winter in the asexual stage, provided suitable host-plants are available, and this seems to be the commonest method by which *M. gei* passes the cold season. It should be stated that these observations were made in the vicinity of Palmerston North.

The Significance of the Presence of the Aphides on Potato-foliage.

As stated at the beginning of this paper, the presence of these aphides on the potato is important, not so much on account of the effect in withdrawing the sap from the plants as in the part the aphides play in transmitting virus diseases—*e.g.*, leaf-roll and mosaic. The term "virus" is well known to potato-growers, and it is almost superfluous to explain that these diseases are carried in the sap of plants. Aphides feed by sucking the sap, and if they happen to be feeding on a virus-infected plant they take in the virus with their food. When such infected aphides feed on healthy plants they inject the virus into the vegetable tissue, and in time the plant will exhibit the typical diseased condition. Virus diseases cause what is known as "degeneration" or "running out," and, according to Whitehead, Currie, and Davies (1932), "it has also been proved that virus diseases alone are responsible for degeneration, or that, if other factors are involved, they fluctuate with virus diseases," which means that the amount of virus disease present is an index to the amount of degeneration.

Of the three aphides characteristic of potato-foliage, only one, *Myzus persicae*, has been shown to be of real importance as a virus vector, and by far the greatest amount of spread of the disease is due to this insect.

In the British Isles it has been a common practice to obtain "seed" potatoes from Scotland because it has been found that such "seed" has not degenerated. The reason for this has been ascribed to the absence of insect vectors in the Scottish growing-areas, and Welsh authorities have considered it worth while to endeavour to discover whether good "seed" growing areas, where degeneration does not occur, could be found in Wales (Whitehead, Currie, and

Davies (*loc. cit.*)). Consequently, various places were chosen because of their different climatic conditions—*e.g.*, exposed or sheltered, or whether they were representative of good growing-areas—the idea being that the aphis population would vary with locality, and by periodical examination it was hoped to discover, under field conditions, what part the aphides played in transmitting degeneration diseases. The result has been that *M. persicae* was found to be the transmitting-agent (Whitehead, Currie, and Davies (*loc. cit.*), W. Maldwyn Davies, 1934). In the experiment in Wales it has been discovered that the most important period to note the presence of *M. persicae* in the crop is early in the growing-season. For various reasons the population of *M. persicae* later in the season is not necessarily indicative of the amount of spread of virus.

A similar scheme to the Welsh one was inaugurated in New Zealand in the 1929-30 summer season, when a line of Arran Chief potatoes was distributed to farmers at Cheviot, Rangiora, Annat, Highbank, Fairlie, and Willowbridge in Canterbury, at Alma in North Otago, at Balfour in South Otago, and at Winton Experimental Farm in Southland. A sample of this same "seed" was also grown at Ashburton Experimental Farm. This line of potatoes was to be grown at each area for several seasons, and after each season's crop a sample of the "seed" was to be sent to Ashburton, the control, where all the samples were then grown side by side, the purpose being to study the amount of virus disease each sample had developed at each growing-area. The results of this experiment have been recently reported on by the Fields Division of the Department of Agriculture in this *Journal* (1935).

It was the duty of the writer to inspect the plots at the various areas in the season 1929–30, and the results of this investigation have been reported in the *New Zealand Journal of Science and Technology* (Cottier, 1931). In view of the results of the work in Wales, it has been thought interesting to consider New Zealand results. In the Fields Division report (*loc. cit.*) "seed" grown at Willowbridge, Rangiora, Alma, and Cheviot showed a progressive increase in virus infection as the experiment was continued. That grown at Highbank, Fairlie, Balfour, Annat, and Winton showed no increase in the amount of virus. Although the insect inspection was carried out in one season only—viz., the first season of the experiment, 1929-30—it is extremely interesting to note that the results show that in December *M. persicae* was most abundant at Alma, Willowbridge, and Rangiora, while at Annat, Highbank, Fairlie, and Winton the numbers of this aphid were very small. Later, however, in January, *M. persicae* was present at these places as follows, the order given being that of decreasing abundance: Balfour, Winton, Highbank, Alma, Fairlie, Annat, Rangiora, and Willowbridge. In March the infestations, in decreasing order of magnitude, were: Fairlie, Alma, Highbank, Willowbridge, Winton, Balfour, and Rangiora. In short, if the position be investigated, it will be noted that the results, as far as they go, interpreted in the light of the Welsh findings, are in agreement with the conclusions reached in Wales, viz.:—

(1) That of the three characteristic aphides, *Myzus persicae* is the most important vector of potato virus disease.

(2) That infestation by *M. persicae* early in the season is the most important factor in the spread of virus disease.

To the writer these conclusions offer the most satisfactory explanation to date of the problem as it appears in this Dominion.

When the New Zealand investigation into the potato-insect fauna was begun it was thought that some places would be discovered where the aphis population was characteristically very small or almost nil over the whole season. This, however, did not prove to be the case. Rather it was found that infestation was general and it would appear that the important thing is not the total amount of infestation in a season, but the amount of infestation by *M. persicae* early in the season. The Fields Division report (*loc. cit.*) states that " the districts producing seed giving rise to crops relatively low in virus infection and relatively high in yield were those which by reason of latitude or altitude were possessed of cooler climates than the districts supplying the remaining lines under trial." During a normal season, in the cooler climates and in exposed situations, the aphides would not secure so early a start as would those in warmer and more sheltered places, although they might breed up to equal numbers later in the season. Thus in the colder and more exposed areas there is a longer period during which the young plants are free from aphis infestation, and this is apparently the reason for their relative freedom from virus diseases.

In connection with the conclusion that freedom from infestation by *M. persicae* early in the season is the most important means of securing success in producing virus free potatoes, it is well to remember that it has been demonstrated in New Zealand (Cottier, *loc. cit.*) as well as in Wales (Davies, *loc. cit.*), that cruciferous crops (swedes, rape, cabbage, &c.) act as over-wintering havens and reservoirs of potential infestation by *M. persicae* to nearby potato fields. So that the greater the isolation of the potato area the smaller will be the chance of infestation by these aphides.

Up to the present time it has not generally been considered an economic proposition to spray large areas of potatoes for the purpose of ridding the fields of virus-carrying aphides, unless such areas are showing wilting due to severe mechanical damage by the insects. In cases where it is deemed advisable to spray, black-leaf 40, 1 part to 800 parts of water, plus soap 2 lb. to 3 lb. per 100 gallons of spray should be used.

ACKNOWLEDGMENT.

Thanks are due to Dr. H. H. Allan, of this Station, for kindly identifying aphis-hosts.

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THE SIZE AND DISTRIBUTION OF DAIRY HERDS IN NEW ZEALAND.

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THE total dairy herd of New Zealand has increased by approximately 500,000 cows since 1929-30. This rapid expansion has taken place coincident with a decline in commodity prices, and there have been many conjectures as to the types of farms on which the major development has taken place. An analysis of holdings, based on herd size, was made by the Government Statistician for the 1929-30 season, and again for the 1933-34 season. Consideration and comparison of the data contained in these tabulations gives us an indication of the direction in which dairying has developed during this period.

The Government Statistician's figures are based on agricultural and pastoral enumerations as at 31st January. For purposes of classification, farms are broken into two groups, namely :—

(1) Holdings wholly or almost wholly devoted to dairying.*

(2) All holdings.

The figures used refer to holdings of one acre or over situated outside boroughs. For this reason the total number of dairy herds shown does not check with the total number of suppliers to dairy factories. For the 1929 30 season the total number of herds enumerated was 65,496†, whilst there were 59,417 suppliers to factories. In 1933-34 there were 70,434 herds enumerated, but 71,837 suppliers were recorded in the factory lists for that season‡. In 1930 there were 19,671 holdings in respect of which returns were submitted showing no dairy cows, whilst in 1934 there were 13,934 holdings in this category.

It can be assumed safely in many instances that these holdings carried cows for the provision of household milk, but were not concerned with factory supply.

The first movements of importance which should be noted, therefore, are that the number of herds enumerated increased and that factory supply had become general by 1934, when factory-suppliers exceeded the total number of herds recorded outside boroughs. It is clear that financial stringency amongst sheep-farmers in the early stages of the depression caused many of them to develop dairy herds of various sizes, and all of them to supply factories with their surplus produce if cream collection was practicable. During the period 1930-34, total production increased by 36 per cent., whereas suppliers to factories increased by 29 per cent.

* Hereafter referred to as "specialized" and "non-specialized" dairy herds or holdings.

† Total holdings outside boroughs: 1929-30, 85,167; 1933-34, 84,368.

‡ Hereafter the 1929-30 season will be referred to as 1930, and the 1933-34 season as 1934.

Table 1.—Total Herds of Dairy Cows and their Distribution, in Group Sizes

Number of Cows.	1930			1934.		
	Number of Herds.	Percentage of Total	Percentage Total Cows represented	Number of Herds	Percentage of Total	Percentage Total Cows represented.
1– 9 ..	32,015	48·9	9·0	28,292	40·2	6·1
10– 19 .	9,027	13·8	9·2	10,769	15·3	7·7
20– 39 ..	12,437	19 0	25·6	13,652	19·4	20·5
40– 59 ..	6.710	10·2	23·0	8,632	12·2	21·7
60– 99 ..	4,195	6·4	22·1	6,679	9·5	25·9
100–149 ..	864	1·3	7 2	1,784	2·5	10·9
150 and over ..	248	0·4	3·9	626	0 9	7·2
Total ..	65,496	100·0	100·0	70,434	100·0	100·0

It will be seen from a study of Table 1 that, coincident with the increase in suppliers, a definite movement has taken place in herd-composition within the supplying-groups. Herds of from one to nine cows have dropped in numbers and in relative importance All the other groups have increased in actual numbers, but those up to fifty-nine cows have decreased in the percentage they represent within the Dominion herd, whilst the larger herds of sixty cows or more assume greater relative importance. Has this movement taken place mainly in specialized or non-specialized herds ?

Specialized and Non-specialized Herds

The basic figures covering both types of herds for 1930 and for 1934 respectively are given in Tables 2 and 3.

Table 2.—Specialized and Non-specialized Herds, 1929–30

Number of Cows	Specialized.			Non-specialized		
	Holdings (Herds)	Area	Cows.	Holdings (Herds)	Area	Cows.
1– 9 ..	9,964	178,763	38,227	22,051	22,814,770	89,734
10– 19 ..	4,656	323,594	67,864	4,371	4,150,805	62,289
20– 39 ..	9,045	1,001,477	263,975	3,392	1,829.598	98,028
40– 59 ..	5,316	855,067	256,402	1,394	711,887	68,494
60– 99 .	3,449	778,532	255.035	746	554,218	57,405
100-149 ..	688	233,694	79,990	176	236,879	21,337
150 and over ..	183	113,519	40.148	65	187,489	14,917
Total ..	33,301	3,484,646	1 001,650	32,195	30,485,646	412,204

Table 3.—Specialized and Non-specialized Herds, 1933 34

Number of Cows.	Specialized.			Non-specialized.		
	Holdings (Herds).	Area.	Cows	Holdings (Herds).	Area	Cows.
1– 9 ..	11,653	199,590	44,897	16,639	18,596,298	72,103
10– 19 ..	5,788	430,230	81.898	4,981	6,223,781	66,208
20– 39 ..	10,340	1,239,090	298,975	3,312	2,676,569	91,093
40– 59 ..	7,155	1,147,390	343,895	1,477	1,136,249	70,489
60– 99 .	5,655	1,224,703	417,368	1,024	916,316	75,586
100-149 ..	1,516	498,735	175,975	268	278,748	31,296
150 and over ..	472	284,734	103,001	154	307,067	35,292
Total ..	42,579	5,024,472	1,466,009	27,855	30,135,028	442,067

It will be noted that in 1930 specialized herds represented 50·8 per cent. of the total, and had increased to 60·5 per cent. by 1934. It is clear that management on many farms has been directed to change from a sheep-dominant to a cow-dominant position during this period. The movement in the various factors are as follows :—

Specialized Group	Percentage Position 1934 relative to 1930.
Number of herds	Increased by 27·9 per cent.
Total area of farms concerned ..	Increased by 44·2 per cent.
Total cows concerned	Increased by 46·4 per cent.

Non-specialized Group	Percentage Position 1934 relative to 1930
Number of herds	Decreased by 13·5 per cent.
Total area of farms concerned ..	Decreased by 1·2 per cent.
Total cows concerned	Increased by 7·2 per cent.

Within the specialized category, increases in cows and in area have been fairly balanced The increase in area, however, is mainly accounted for by those farms which have changed over to cow-dominant propositions It will be seen at a later stage that cow increases are mainly influenced by increments in established herds In the non-specialized group, the number of herds are affected by the switch to "specialized," and the increase in cows is wholly accounted for by enlargement of the dairying side of enterprises already devoted to mixed sheep and dairy farming

Changes in Grouping of Herds on Basis of Size.

The trend towards enlargement of existing herds, and the increasing relative importance of larger herds in the industry, is demonstrated in a comparison of the percentage of the total, which is represented by herds falling within definite size groups. In Table 4 the position in 1930 is compared with that in 1934. In the specialized groups, although the total number of cows in herds of under forty has increased, the percentage of the whole which they represented in 1934 has declined, whereas herds of above forty cows have rapidly increased in relative importance. In the non-specialized groups, small herds of under ten cows have declined in number, whilst others have increased in number and in relative importance. This is specially true of the larger herds on non-specialized holdings.

Wherever practicable, the dairy herds on sheep and mixed farms have been increased in size, and particularly so on farms of about 1,000 acres where comparatively small herds have been developed to augment incomes and to provide some cash income each month.

Table 4.—Percentage Position on Herd Sizes.

Number of Cows.	Specialized.		Non-specialized.	
	1930.	1934.	1930.	1934.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1– 9	29·9	27·4	68·5	59·8
10– 19	14·0	13·5	13·6	17·9
20– 39	27·2	24 3	10·5	11·9
40– 59	16·0	16·8	4·3	5·3
60– 99	10·4	13·3	2·3	3·7
100–149	2·1	3·6	0·5	0·9
150 and over ..	0·4	1·1	0·2	0·5

Size of Holdings.

The validity of the break-up of herds into specialized and non-specialized dairying undertakings can be gauged from the average size of the holdings concerned and the average area per cow as shown in Table 5. The specialized group in 1930 obviously includes small areas which are devoted partially to other activities and small farms which are not fully developed. Those farms carrying larger herds were apparently well developed on the average. The transference from non-specialized to specialized has apparently been mainly farms of small area which have built up herds from ten to thirty-nine cows. Such farms were larger on the average than those milking similar-sized herds in 1930, and result in a less intensive stocking in farms now carrying such herds. On the whole, however, they are typical dairy-farms in area and in utilization. The average area of the non-specialized group, and the resultant area per cow, suggest that the increase in enumerated herds has been mainly on large holdings, while the herds on large holdings which previously returned dairy herds have been increased also, thus moving them into higher grouping.

Table 5.—Group Positions according to Area of Holdings and Area per Cow (in Acres)

Number of Cows.	Specialized				Non-specialized.			
	1930.		1934		1930		1934	
	Area of Holding.	Area per Cow.	Area of Holding.	Area per Cow.	Area of Holding.	Area per Cow.	Area of Holding.	Area per Cow.
1– 9 ..	18	4·7	17	4·4	1,035	220·2	1,118	261·4
10– 19 ..	70	4·8	74	5·2	927	64·8	1,250	94·0
20– 39 ..	111	3·8	119	4·2	539	18·6	808	29·4
40– 59 ..	161	3·3	160	3·3	511	10·4	769	16·1
60– 99 ..	226	3·1	217	2·9	743	9·7	894	12·1
100–149 ..	340	2·9	329	2·8	1,346	11·1	1,400	12·0
150 and over	620	2·8	603	2·8	2,884	12·6	1,929	8·4

SUMMARY, PERIOD 1930–34.

(1) It has become a recognized practice for farmers to supply factories with their surplus butterfat wherever collection is practicable, but over 40 per cent. of suppliers have herds of under ten cows.

(2) The number of farmers who submit returns showing dairy herds on their property has increased materially.

(3) Dairying has assumed a dominant position in an increasing number of farm enterprises.

(4) The major increases in dairy cows have taken place on specialized dairying holdings.

(5) On specialized holdings the major increases have taken place on farms carrying forty cows or more.

(6) Although a number of non-specialized holdings carries large dairy herds, the relative importance of these herds in the dairying industry is small

In Central Otago a farmer has successfully harvested two crops of seed—rye-grass and white clover—from one paddock at different intervals in the one season. The rye-grass ripened first, and this was harvested directly with the header-harvester, leaving the bottom 6 in. to 8 in. of the sward containing clover untouched A few weeks later, when the clover was ripe, the crop was windrowed. When this was dry the windrows were picked up by the header-harvester and threshed.

CONTROL OF CLUB-ROOT IN CABBAGE SEED-BEDS.

J G GIBB. Mycological Laboratory, Plant Research Station, Palmerston North

CLUB-ROOT is a disease which attacks cabbage, cauliflower, brussels sprouts, and allied crops. It produces a tumid distortion of the roots, and often causes wilting and premature death of the plants. Infection is caused by spores in the soil. To obtain healthy seedlings, which are essential to the production of healthy crops, the spores may be eradicated from infected seed-beds by soil disinfection. Commercial growers possessing high-pressure boilers will find steam disinfection the most economical method; but where steam is not available a chemical disinfectant must be used. At the Plant Research Station, Palmerston North, three seasons' experiments on heavily infected ground* have shown that a 0·1 per cent. acidulated solution of mercuric chloride is the only economically efficient disinfectant for the eradication of club-root from the soil. The treatment costs approximately 4d per square yard†, and must be applied before sowing. It has no detrimental effect on subsequent germination or growth. *Mercuric chloride solutions are strong poisons and rapidly corrode metals. They should be kept out of reach of children and stock, and containers should be washed after use.* As corrosion weakens the disinfectant, the tins and watering-cans used during application should be protected by rinsing every two hours with benzine containing a little oil.

METHOD OF APPLICATION.

A concentrated solution of the disinfectant which may be kept bottled indefinitely is made up as follows: Mercuric chloride (powder), 1 lb.; commercial concentrated hydrochloric acid, 3 lb. The seed-bed should be prepared for sowing and divided into areas of 2 square yards. Water in 4-gallon tins is carried to the bed, and there 1⅝ fluid ounces of the concentrated solution rapidly stirred in. The disinfectant solution so formed should be distributed immediately through a fine rose evenly over the 2 square yards previously marked out. Penetration of the disinfectant is deeper when the surface soil is moist and when a gallon of clean water per square yard is applied about an hour after treatment. The seed-bed should be left for ten days before sowing.

The efficiency of the method depends on (i) the rapidity with which the mercuric chloride solution can be poured on the soil, and (ii) the prevention of reinfection by disease-carrying soil. Implements and boots should be disinfected in a solution of mercuric chloride immediately before working on treated beds: for doing this a wooden bucket containing ⅝ fluid ounce of the concentrated solution per gallon of water, placed near the seed-beds, is helpful. For satisfactory disinfection it is advisable to wash adhering earth from the implements, &c., and to keep them damp with the disinfectant for ten minutes. Metal implements should not be left immersed in the mercuric chloride solution for more than a few seconds.

* Full details of these experiments were published in the *Journal of Sci. and Tech.*, Vol. 14, pp. 145–51, 1932, and Vol. 16, pp. 159–62, 1934.

† This price is calculated with the retail price of mercuric chloride at 15s. per pound, but by co-operative buying the price of treatment should be reduced to less than 2½d. per square yard.

SEED-WHEAT CERTIFICATION.

CERTIFIED CROPS

UNDER the Government scheme for the certification of seed-wheat, the following additional growers have seed for sale from crops which have passed both field and grain inspections (Previous lists, to which purchasers are referred, were published in this *Journal* in February, March, and April, 1935)

Variety.	Grower	Acreage.
Hunter's II ..	Brown, F G, Grassy Hills, Waimate .. .	25
	Cooper, H J, Opaki, Masterton . ..	9
	Porter, B G, Tokarahi, Oamaru	30
Solid Straw Tuscan	Marshall, J H, Fycho, R M D, Timaru ..	8
	McLachlan Bros, Rangitumau, Masterton	5
	Lambrick, R E, Mount Hutt, R M D, Rakaia .	13

Fields Division

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents published with abridged specifications in the *New Zealand Patent Office Journal* from 4th April to 2nd May, 1935, include the following of agricultural interest

No 73352 Cutting-edge of plough-share, G M Reynolds No 73535: Spraying-apparatus, M D. Wibmer, J C de la Mare, and A R S Chaplin. No 73587 Egg-cleaning device, A R Betteridge No 72234 Harrow, A S. Bevin. No 72503 Cooling cream, M Morison and A Oates No 72506 Harrow (cognate with No 72234 above) No 72009 Tine for sweep, W R. Clough No 73543 Wood preservation, G Gunn No 73634 Milk and cream cooler, The Berry Engineering Works, Ltd. No 73048 Dewoolling sheep-skins; J Wilson, T S Bull, and C J F Jolly

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

The Fields Instructor, Greymouth, reports that a Rotomana farmer weighted silage in rather a novel manner. He put in a stack of about 40 tons of silage, then immediately stacked from 10 to 15 tons of hay on top Both hay and silage are of very satisfactory quality, and there is no mould in hay nor between hay and silage

It is commonly agreed among sheep-farmers that hoggets do not readily commence eating silage and in consequence the method successfully adopted by a farmer at Taihape is of some interest. The silage being utilized is made from lucerne, but, unlike the usual material from this source, is almost dry, and approximates the nature of heavily sweated hay There is an entire absence of any fluid exuding from the pit, and the silage, although quite green in colour, has a very pleasant aroma Absolutely no difficulty has ever been experienced in regard to hoggets acquiring a taste for this material right from the start The method of making this class of silage consists of mowing the lucerne and leaving it in the swath until it would be considered ready for cocking as for hay At that stage it is filled quickly into the pit and covered There is no doubt that the resultant product is a very fine fodder for sheep The method employed is indicated by the fact that the whole paddock on a recent occasion was cut, and when ready for raking one-half went into the ensilage pit, the remainder being raked and cocked for curing as hay The latter was a splendid green sample in the stack.—*Report, Fields Superintendent, Palmerston North.*

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1934-35.

PROVISIONAL certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certification-tags to be attached to the sacks are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes and is satisfied that they are still of the same standard of purity and freedom from disease as was indicated by the field inspection.

Each crop has received a group number, which indicates as accurately as possible the merits of its produce for seed purposes in relation to the merits of the produce of the other provisionally certified crops of the same variety. Group 1 is the highest and Group 10 the lowest The difference between any two consecutive groups is small, and in making comparisons the cost of seed and transport should receive consideration.

Crops are also divided into two classes—namely, (1) Certified "Mother" seed ; (2) certified "Commercial" seed Areas sown with certified mother seed are eligible for entry into certification. Areas sown with certified commercial seed are not eligible for entry into certification, except in cases where the seed planted has been raised by the entrant (grower) himself. Growers who intend to purchase seed with the object of entering certification must therefore purchase certified mother seed

LIST OF GROWERS

Name and Address.	Group No	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP.			
Mother Seed—			
Adams Bros , Sheffield (Line A)	2	..	7
Adams Bros , Sheffield (Line B)	2	.	1
Alexandre, H , Belfast	3	.	4
Amor, A W , Woodend (Line A)	3	..	3
Amor, A W , Woodend (Line B)	2	0·6	3
Amor, A W , Woodend (Line C)	1	0·2	2
Amyes, H C , "Riversleigh," Annat	2	..	2
Anderson's Estate, Lincoln (Line A)	2	.	1½
Anderson's Estate, Lincoln (Line B)	3	0·2	1½
Anderson's Estate, Lincoln (Line C)	3		3
Armstrong, P L , Fernside, R.M D , Rangiora	2	..	5
Bailey, J , R M.D , Kaiapoi	3	.	3
Ballantyne, R F., 58 Hanson Road, Upper Riccarton, Christchurch	2	.	1
Barnett, R., Dunsandel	2	..	3
Barr, H C , Prebbleton-Springston, R.M.D.	2	..	4
Basher, W F., care of F. E Larcombe, Springston, R M D	2	..	3
Bennett, R. R , Eyreton-Kaiapoi, R.M.D	3	..	2
Breitmeyer and McFarlane, Little River (Line A)	3	0·2	2
Breitmeyer and McFarlane, Little River (Line B)	3	0·5	2
Brown, G E., Kaiapoi, R.M D. (Line A)	2	..	2
Brown, G E., Kaiapoi, R.M.D. (Line B)	2	..	2
Burgess, R. W , care of F. Merrin, Eyreton-Kaiapoi, R M D	3	..	2
Caldwell, G , Courtenay, R.M.D.	2	..	3
Carroll, Mrs. A., Southbridge	1	..	8
Carroll, F. A., Southbridge	3	..	2
Carroll, J., Southbridge	1	..	4
Carroll, T F., Southbridge	3	..	4
Chambers, A J., "Carberry," Weedon's	2	..	1
Cherry Bros , Kaiapoi, R.M.D.	2	..	2
Cross, A. E., "Pine Farm," Bennett's, via Rangiora (Line A)	2	..	1
Cross, A. E , "Pine Farm," Bennett's, via Rangiora (Line B)	3	..	1½
Cross, H. E , Sandy Knolls	1	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties	Area in Acres
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed—continued.			
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line A) ..	1	..	3
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line B) ..	1	..	1
Crump, F., Springston, R.M.D. (Line A)	2	0·3	3
Crump, F., Springston, R.M.D. (Line B)	3	..	1
Dyer, H., Southbrook	3	..	3
Eder, T. W., Rangiora-Horrelville, R.M.D.	3	0·5	2
Eder, W., Sefton, R.M.D. (Line A)	2	0·1	3
Ferguson, J. W., R.M.D., Winchmore	3	0·9	5
Foster, T. C., Ladbrook's, R.M.D. (Line A)	3	0·2	7
Foster, T. C., Ladbrook's, R.M.D. (Line B)	3	..	3
Foster, T. C., Ladbrook's, R.M.D. (Line C)	2	..	3
Franks, L. J., 88 Russley Road, Christchurch	2	1·6	4
Gilbert, D. R., East Oxford	2	..	1
Guy, T. A. and E. B., Yaldhurst	3	..	6
Harris, C., Sawyer's Arms Road, Harewood (Line A) ..	2	..	1
Harris, C., Sawyer's Arms Road, Harewood (Line B) ..	2	..	2
Hegan, J., and Son, Southbrook (Line A)	2	..	2
Hegan, J., and Son, Southbrook (Line B)	3	0·5	5
Henderson, G., Courtenay, R.M.D.	2	..	2
Heron, F., Rangiora, R.M.D.	3	1·3	15
Hobday, J. H., 33 St. John Street, Papanui, Christchurch	2	..	2
Jellie, J., Russley Road, Upper Riccarton, Christchurch ..	3	..	3
Johnston, R. H., Dunsandel	2	..	2
Kavanagh, D., 50 Ryan's Road, Upper Riccarton, Christchurch	2	..	4
Kenyon, F., Mina, North Canterbury (Line A) . .	2		1
Kenyon, F., Mina, North Canterbury (Line B)	2	..	1½
King, G. H., West Belt, Rangiora	3	0·4	5
Marshall, D., Killinchy-Leeston, R.M.D. . ..	1	..	10
Marshall, W. H., Prebbleton	2	..	1
Martin, W. E., Kaiapoi, R.M.D. (Line A) . ..	3	..	8
Martin, W. E., Kaiapoi, R.M.D. (Line B) . ..	3	.	3
Matson, A. L., Box 3, Christchurch (Line A) . ..	3	0·1	4
Matson, A. L., Box 3, Christchurch (Line B) .. .	2	..	3
Morgan, D., R.M.D., Cheviot, North Canterbury ..	1	..	8
Mortland, Mrs. S., Templeton	2	..	2
Mulcock, W. J., Ryan's Road, Upper Riccarton, Christchurch	3	.	1½
Murphy, J., Springston, R.M.D.	3	.	3
McPhail, W. A., Mitcham, via Rakaia	2	..	2
Nairn, G., Lakeside-Leeston, R.M.D. (Line A) . ..	2	0·2	2
Nicklaus, J. F., 104 Ryan's Road, Upper Fendalton, Christchurch	1	..	4
Oakley, J. T., Eiffelton, R.M.D. (Line A) . .	3	..	2
Oakley, J. T., Eiffelton, R.M.D. (Line B) ..	3	..	3
Oakley, W., Halkett, R.M.D. (Line A)	1	..	5
Oakley, W., Halkett, R.M.D. (Line B)	2	..	4
Oliver, W. R., Hororata	2	..	1
Overton, H. M., Lakeside	2	..	2
Pascoe, S., Halkett, R.M.D.	3	..	1
Petrie, H. H., Swannanoa, R.M.D.	2	..	8
Petrie, J., jun., Swannanoa, R.M.D.	2	.	2
Petrie, J., sen., Swannanoa, R.M.D.	2	0·1	4
Poulton, A. D., West Eyreton, R.M.D. .. .	3	0·8	2
Prebble, R. L., Springston, R.M.D.	2	..	3
Prisons Department, Paparua	3	..	6
Prosser, L. W., Leeston, R.M.D.	2	0·8	3
Proudlock, A., East Eyreton-Kaiapoi, R.M.D. (Line A) ..	3	..	4

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed—continued.			
Purvis, G., Oxford Road, Rangiora	3	..	2
Rangiora High School, Rangiora (Line B)	2	0·2	5
Rathgen, A. E., Killinchy-Leeston, R.M.D.	2	..	5
Redmond, C., Kimberley, R.M.D.	1	..	20
Redmond, W. G., Courtenay, R.M.D.	2	1·0	2
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch	3	..	6
Rolston, G., Weedon's-Greendale, R.M.D.	1	..	4
Roper, P. F., Halkett, R.M.D.	1	..	3
Roper, R. S., Halkett, R.M.D.	3	0·8	4
Royds, G. E., 12 Burnside Road, Fendalton, Christchurch (Line A)	3	..	3
Royds, R. S., 12 Burnside Road, Fendalton, Christchurch (Line A)	2	..	6
Schluter Bros., Rangiora	2	..	14
Seaton Bros., Courtenay, R.M.D.	3	1·0	2
Smith, E. A., Springston, R.M.D. (Line A)	3	0·6	15
Smith, E. A., Springston, R.M.D. (Line B)	2	..	4
Steele, J., Kimberley, R.M.D.	3	..	1
Stewart, A., Marsh's Road, Templeton	1	..	3
Stoddart, G., Lincoln	2	..	2
Swanson, W., Selwyn	2	..	3
Thomas, J. W., Gray's Road, Upper Fendalton, Christchurch	2	..	3
Tweedy, S., Dunsandel, R.M.D.	2	0·2	1
Ward, C. R. T., Ladbrook's	2	..	2
Watson, R. G., Springbank-Rangiora, R.M.D. (Line B)	2	0·3	3
Weeber, H., Englefield Road, Belfast (Line A)	3	..	3
Weeber, H., Englefield Road, Belfast (Line B)	2	..	2
Westaway, R. J., Courtenay, R.M.D.	2	0·5	10
Williams, C. M., Box 19, Kaiapoi	3	0·7	3
Wilson Bros., Halkett, R.M.D. (Line A)	2	..	3
Wilson Bros., Halkett, R.M.D. (Line B)	3	..	1
Wilson, M., Halkett, R.M.D.	3	0·6	2
Wilson, W. A., Halkett, R.M.D.	1	..	3
Wolff, R. G., Horrelville, R.M.D.	1	..	3
Wright, L. T., Annat	2	..	10
Wright, Q. A., Annat	2	..	6
Commercial Seed—			
Adams, K. and R., Sheffield	4	..	3
Ballantyne, C. T., Geniti, Timaru	4	..	1
Ballantyne's Estate, Fairview, Timaru	6	0·2	4
Banks, L. C., Lincoln-Greenpark, R.M.D.	4	..	5
Boyle, A. D., Orari	4	0·2	1
Burrell, T. F., Levels, South Canterbury	4	..	1
Couper, R. P., Washdyke, Timaru	4	..	1
Crawford, A. W., 140 Belfast Road, Belfast	5	..	5
Dale, W. S., Kennerley, Temuka	4	..	1
Dowdle, T. S., Prebbleton	4	..	2
Eder, W., Sefton, R.M.D. (Line B)	4	0·5	7
Gaffeney, Mrs. M. F., Arowhenua, Temuka	4	..	2
Gray, J. L., St. Andrew's (Line A)	5	0·3	2
Gray, J. L., St. Andrew's (Line C)	4	..	3
Gray, R., St. Andrew's (Line A)	4	..	2
Gray, R., St. Andrew's (Line B)	6	0·5	6
Haines, C., 108 Waimak Road, Harewood	4	..	2
Ham, A., Grovetown, Blenheim	6	0·4	1½
Hastie, A. W., Pareora, Timaru	4	..	1
Kelleher, T., Pleasant Point, South Canterbury (Line A)	4	..	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No	Percentage of Foreign Varieties	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed—continued.			
Kelleher, T, Pleasant Point, South Canterbury (Line B) ..	5	0·2	4
King, W. H, Rosewill, Timaru (Line A)	4	.	1
Mills, F. F., Grovetown, Blenheim	4	0·6	1
Musson, W R, Rangiora	4	0·3	3
McCullough, S. G, Rangitira Valley, Temuka	4	..	1
Oliver, J O J, Factory Road, Temuka (Line A)	5	..	1
Oliver, Mrs Z M, Temuka	4	..	1
Porter, E, St Andrew's (Line A)	4	.	2
Proudlock, A, East Eyreton-Kaiapoi, R.M.D (Line B)	4	1·1	4
Reynolds, H, Watson's Road, Harewood	5	.	2
Rich, A J, Kaiapoi, R M D	6	..	13
Rose, H J, Scott Street, Blenheim	4	1·0	1
Ross, A., Washdyke, Timaru (Line A)	4	..	1
Ross, A, Washdyke, Timaru (Line B)	4	0·2	1
Rouse, J, St Andrew's	4	..	2
Royds, G E, 12 Burnside Road, Fendalton, Christchurch (Line B)	4	..	12
Royds, R S, 12 Burnside Road, Fendalton, Christchurch (Line B)	4	0·4	2
Saunders, W, Clandeboye, Temuka	5	.	1
Seivwright, R M, "Meadows," Washdyke	5	0·2	3
Sharlick, J, Marshlands Road, Ouruhia, Christchurch	4	..	2
Shillitto, R S, 135 Armagh Street, Christchurch	4	.	2
Simpson, F F, Morven (Line A)	5	.	2
Smith, R S., "Beach Farm" St Andrew's	4	0·3	1
Steven, G H, Rosewill, Timaru	4	0·5	2
Topham, J W, Arowhenua, Temuka	6	..	3
Traves, H, Levels, South Canterbury	4	0·2	1
Walsh, G, Levels, South Canterbury	4	..	1
Weeber, H, Englefield Road, Belfast (Line C)	4	..	6
DAKOTA			
Mother Seed –			
Alexandre, H., Belfast (Line B)	5	.	3
Allen, A, R.M D., Leeston	3	..	9
Banks, L C, Lincoln-Greenpark, R M D	3	..	1
Barnes, A C, Cheviot, R M D	5	..	1
Barnett, R, Dunsandel	3	..	4
Barr, H C., Prebbleton-Springston, R.M D	5	..	7
Benny, G, Southbridge	4	..	1
Boyce, A, Doyleston	5	..	5
Burrowes, J, Chertsey, Mid-Canterbury (Line A)	5	..	12
Campion, C. A, Highbank, Methven	3	..	20
Carpenter, A. M. and F., Fernside-Rangiora, R M D (Line A)	5	..	1
Carpenter, A M and F., Fernside-Rangiora, R M D (Line B)	4	..	3
Carr, J, Methven	5	.	5
Chambers, A. J., "Carberry," Weedon's, R.M D	4	..	4
Chambers, L. J, "Carberry," Weedon's, R M D.	4	..	4
Chambers, R., Rolleston	5	..	20
Chambers, W. J, "Carberry," Weedon's, R M.D. (Line A)	5	..	5
Cherry Bros., Kaiapoi, R M.D.	5	..	2
Cross, A. E., Pine Farm, Bennett's, via Rangiora	4	..	1
Cross, H. E., Sandy Knolls (Line A)	4	..	4
Cross, H. E., Sandy Knolls (Line B)	3	..	2
Crozier, W. J., Mount Hutt, R M.D., Rakaia (Line A)	2	..	10
Crozier, W. J., Mount Hutt, R.M.D, Rakaia (Line B)	3	..	3
Donaldson, A., Mitcham, via Rakaia	5	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Mother Seed—continued.			
Gardiner, C., Mitcham, via Rakaia	3	..	5
Gardiner, O. J., Dunsandel	2	..	12
Guy, T. A. and E. B., Yaldhurst	4	..	1
Hegan, J., and Son, Southbrook	5	..	3
Hennessey, W., Mitcham, via Rakaia	3	..	1
Hill, L. F., Eiffelton, R.M.D.	4	..	5
Hooper, R. M., Mitcham, via Rakaia (Line A)	4	..	5
Hooper, R. M., Mitcham, via Rakaia (Line B)	4	..	5
Johnston, H. W., Dunsandel	3	..	16
Johnston, R. H., Dunsandel	3	..	2
Jowers, G. C., Springston, R.M.D. (Line C)	3	..	3
Lambie, R. T., Leeston	4	..	5
Leslie, A., Springston, R.M.D	3	..	2
Manson, C. F., Kimberley, R.M.D.	3	..	4
Marshall, D., Killinchy-Leeston, R.M.D.	4	..	10
Meyer, J. H., Ladbrook's	5	..	8
Miller, J. E., Killinchy-Leeston, R.M.D.	5	..	3
Moorhead Bros., Southbridge	4	..	8
Morrish, F. E., Springston	5	..	4
McCartin, J., Leeston	5	..	5
McLachlan, T. C., Leeston	5	..	10
McPhail, W. A., Mitcham, via Rakaia (Line A)	3	..	12
McPhail, W. A., Mitcham, via Rakaia (Line B)	5	..	1½
McRobb, A., Mitcham, via Rakaia	3	..	1
Nicklaus, J. F., 104 Ryan's Road, Upper Riccarton, Christchurch	3	..	1
Nixon's Estate, Killinchy-Leeston, R.M.D.	5	..	7
Oakley, J. T., Eiffelton, R.M.D	5	..	2
Oakley, W., Halkett, R.M.D.	3	..	1
Payne, J. W., Lincoln	3	..	3
Petrie, A. D., Woodend	5	..	2
Petrie, J., jun., Swannanoa, R.M.D.	3	..	1½
Petrie, J., sen., Swannanoa, R.M.D.	4	..	5
Phillips, A., Weedon's, R.M.D	5	..	9
Phillips, A. G., Weedon's, R.M.D.	4	..	4
Phillips, W., Springston, R.M.D	4	..	4
Piner, E., Annat. R.M.D.	4	..	2
Robinson, R. P., Waikuku	5	..	3
Robson, F. H., Box 27, Lincoln	5	..	12
Rolston, G., Weedon's-Greendale R.M.D	3	..	11
Royds, R. S., 12 Burnside Road, Fendalton, Christchurch (Line A)	5	..	2
Ryan, P. F., Weedon's, R.M.D	4	..	10
Seaton Bros., Courtenay, R.M.D.	5	..	2
Shellock, W., Te Pirita, R.M.D., Rakaia	3	..	12
Steele, J., Kimberley, R.M.D. (Line A)	3	..	1
Stewart, A., Marsh's Road, Templeton (Line B)	5	..	5
Swanson, W., Selwyn	3	..	2
Tweedy, S., Dunsandel	4	..	10
Walker, C. E., Estate of, West Melton, R.M.D.	3	..	6
Watson, E., Dunsandel	3	..	7
Williams, J. W., Halswell	4	..	5
Winter, E. R. V., Brookside (Line A)	4	..	4
Winter, E. R. V., Brookside (Line B)	3	..	1
Wilson, M., Halkett, R.M.D. (Line A)	4	..	2
Wilson, M., Halkett, R.M.D. (Line B)	4	..	3
Wolff, R. G., Horrelville, R.M.D.	3	..	7
Wright, Q. A., Annat	3	..	6

LIST OF GROWERS—*continued.*

Name and Address.	Group No	Percentage of Foreign Varieties	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed—			
Adams Bros., Sheffield	6	..	1
Alexandre, H., Belfast (Line A)	6	..	3
Amor, A. W., Woodend	7	..	7
Ballantyne, C. T., Gleniti, Timaru	7	..	5
Berry and Halliburton, 28 Dundas Street, Christchurch (Line A)	7	..	3
Burrowes, J., Chertsey, Mid-Canterbury (Line B)	6	..	9
Chambers, W. J., "Carberry," Weedon's, R.M.D. (Line B)	6	..	4
Dale, W. S., "Kennerley," Temuka	6	..	1
Elder, R. P., John's Road, Belfast	6	..	3
Giles, N., Seadown, Timaru (Line A)	6	..	2
Giles, N., Seadown, Timaru (Line B)	7	..	3
Grant, A., Waimate	6	..	4
Mills, F. F., Grovetown, Blenheim	7	..	1
Minchington, F. W., Fernside, Rangiora	6	..	1
Musson, W. R., Rangiora	6	..	2
McCullough, S. G., Rangitira Valley, Temuka	6	..	1
Norman, F. J., Springlands, Blenheim	6	..	4
Pannell, W. B., Rangiora, R.M.D.	6	..	7
Parker, F. A., Spring Creek, Blenheim	7	..	5
Philp, F., Seadown, Timaru (Line A)	6	..	2
Prisons Department, Paparua	6	..	6
Prosser, J. T., Leeston	6	..	5
Reynolds, H., Watson's Road, Harewood (Line A)	6	..	2
Schaffer, F. L., Weedon's-Springston, R.M.D.	6	..	27
Seymour, J., Hawthornden Road, Christchurch	6	..	11
Smart, L. E., Box 3, Lincoln	6	..	7
Steele, J., Kimberley, R.M.D. (Line B)	6	..	1
Steven, G. H., Rosewill, Timaru	6	..	6
Stewart, A., Marsh's Road, Templeton (Line A)	6	..	5
Stoddart, G., Lincoln	7	..	3
Thomas, D., Springston	6	..	10
Ward, W. J., Ohape, Temuka (Line A)	6	..	2
ARRAN CHIEF			
Mother Seed—			
Anderson, A., Stirling	3	0·6	4
Barclay, G. M. M., Riverlands Road, Waimate (Line A)	4	..	1
Batchelor, R. S., Waimate	4	..	1
Bennett, J., jun., Papatotara, R.M.D.	3	0·5	2
Boyce, W. J., Waituna, Waimate	4	0·2	1
Campbell, P., Studholme Junction (Line A)	4	..	1
Court, R. T., Swannanoa, R.M.D.	4	..	9
Cox, S., Willowbridge	4	..	3
Croft, R., "Glenlea," Amberley	3	..	2
Daly, P. G., Te Waewae	3	1·2	1½
Dobbie, R., Menzies' Ferry	2	1·7	1
Fletcher, W. J., "Hopefields," Willowbridge (Line A)	4	..	2
Graham, Mrs. K. G., Mataura	4	1·0	1
Griffin, J. G., Te Waewae	2	0·2	3
Hamilton, G., Papatotara, R.M.D.	4	1·0	1
Harvey, W., Mosgiel	3	0·2	2
Knowler, C. E., Box 97, Tuatapere	3	0·4	3
Knowler, H., Te Waewae	2	..	4
Knowler, H. C., Te Waewae	3	..	3
Reid, J. M., Box 29, Willowbridge	4	..	1
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch (Line A)	3	..	2
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch (Line B)	3	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
ARRAN CHIEF—*continued.*			
Mother Seed—continued.			
Rollinson, F. A., and Sons, Studholme Junction (Line A) ..	4	..	4
Rollinson, F. A., and Sons, Studholme Junction (Line B) ..	4	..	3
Ruddenklau, J. G., The Valley, Glenavy	4	..	7
Saunders, E. E., Studholme Junction (Line A)	4	..	2
Saunders, E. E., Studholme Junction (Line B)	4	..	6
Smith, W. J. M., Seadown, Timaru	4	..	3
Teschner, C. A., Knapdale, R.M.D., Gore	4	1·3	3
Topham, J. W., Arowhenua, Temuka (Line A)	4	0·3	1
Topham, J. W., Arowhenua, Temuka (Line B)	4	..	1
Weir, J. G., Stirling	3	0·3	2
Wright, L. T., Annat	3	..	10
Wright, Q. A., Annat	4	..	1
Commercial Seed—			
Barclay, G. M. M., Riverlands Road, Waimate (Line B) ..	6	..	7
Barclay, G. M. M., Riverlands Road, Waimate (Line C) ..	6	0·2	2
Barnes, W., and Son, 199 Highsted Road, Styx	5	..	5
Beckingsale, J. H., Clearview Settlement, Herbert ..	7	1·6	1
Bruce, J. A., Otahuti, R.M.D...	5	1·4	2
Campbell, P., Studholme Junction (Line B)	6	..	5
Crawford, A. W., 140 Belfast Road, Belfast	5	..	3
Henderson Bros., Otapiri, R.M.D., Winton	6	1·5	2
Henshaw, J. F., Studholme Junction (Line A)	5	..	2
Henshaw, J. F., Studholme Junction (Line B)	6	..	2
Leathwick, A., Hunter, R.M.D.	5	..	7
Leech, C., Rangiora	6	..	4
Manson, D., Enfield, Oamaru (Line A)	6	0·3	1
Manson, D., Enfield, Oamaru (Line B)	7	..	2
Morrison, J. L., Morven	7	..	2
McCarthy, E., Prebbleton (Line A)	5	0·2	5
Oliver, J. O. J., Factory Road, Temuka	6	..	3
Rollinson, F. A., and Sons, Studholme Junction (Line C) ..	5	..	12
Smith, C. R., Bushy, R.M.D., Palmerston	5	1·4	1½
Thomas, R. B., Waihoaka, Southland	5	1·4	2
Topham, J. W., Arowhenua, Temuka (Line C)	7	..	3
ARRAN BANNER			
Mother Seed—			
Amyes, H. G., "Riversleigh," Annat	3	..	1½
Bennett, J., jun., Papatotara, R.M.D.	3	..	2
Bruce, J. A., Otahuti, R.M.D., Invercargill	4	..	1½
Burgess, D., West Plains, Invercargill	4	..	1
Carr, C., Pukemaori, R.M.D.	4	..	1½
Knowler, C. E., Box 97, Tuatapere	4	..	1
Knowler, H., Te Waewae	4	..	1
Kokav, S., Tuatapere	2	..	2
Milburn, M., Wright's Bush, R.M.D., Invercargill ..	4	..	1
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch ..	3	..	2
Sheddan, G. B., Otahuti, R.M.D. (Line A)	3	..	1
Wilson, C. H., Lorneville, Invercargill	4	..	1
Wright, L. T., Annat	2	..	5
Commercial Seed—			
Barnes, W., and Son, 199 Highsted Road, Styx	5	..	5
Bird, A. M., Timaru Road, Waimate	5	0·2	2
Craig, G. H., Mosgiel (Line A)..	6	..	1
Craig, G. H., Mosgiel (Line B)..	6	..	1
Harvey, W., Mosgiel	7	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group. No.	Percentage of Foreign Varieties.	Area in Acres.
ARRAN BANNER—*continued.*			
Commercial Seed—continued.			
Leathwick, A., Hunter, R.M.D., South Canterbury	7	..	2
McNae, F., Courtenay, R.M.D.	6	0·6	5
Oakley, W., Halkett, R.M.D.	5	..	5
Robinson, D. B., Waikuku	7	0·5	2
Robinson, R. P., Waikuku	7	0·2	3
Roper, P. F., Halkett, R.M.D.	5	..	2
Sheddan, G. B., Otahuti, R.M.D. (Line B)	7	..	1
Simmons, W., Kingsdown, Timaru	5	..	1
Smith, C. R., Bushy, R.M.D., Palmerston	7	..	1½
KING EDWARD			
Mother Seed—			
Anderson, A., Stirling (Line A)	4	..	1
Anderson, A., Stirling (Line B)	4	..	4
Bennett, T. A., Te Tua, Southland	4	0·5	2
Burgess, D., West Plains, Invercargill	4	..	1½
Griffin, J. G., Te Waewae	3	..	2
Kokay, S., Tuatapere	3	..	10
Knowler, H. C., Te Waewae	4	..	1
Mehrtens, L. C., Box 27, Tuatapere	4	..	1
Milburn, M., Wright's Bush, R.M.D., Invercargill	3	..	1
Miller, R., East Taieri	4	..	1
Commercial Seed—			
Bruce, J. A., Otahuti, R.M.D.	5	..	1
Craig, G. H., Factory Road, Mosgiel	6	..	3
Graham, J. W., Factory Road, Mosgiel (Line A)	5	..	4
Graham, J. W., Factory Road, Mosgiel (Line B)	5	0·2	2
Graham, J. W., Factory Road, Mosgiel (Line C)	6	..	1½
Kenny, J., Mosgiel	5	..	4
Marshall, W., and Sons, Outram (Line A)	5	..	2
Marshall, W., and Sons, Outram (Line B)	6	..	2
Penn, T. A., 154 Innes Road, Christchurch	6	..	1
AUCKLANDER TALL TOP.			
Mother Seed—			
Court, R. T., R.M.D., Swannanoa (Line A)	4	..	7
Cross, H. E., Sandy Knolls	3	..	2
Eder, W., Sefton, R.M.D.	4	..	1
Frost, C. H., Balcairn P.O.	3	..	5
Guy, T. A. and E. B., Yaldhurst	2	..	3
Marshall, W. H., Prebbleton	4	..	1
Minchington, F. W., Fernside, Rangiora	3	..	3
Reynolds, H., Watson's Road, Harewood	3	..	4
Steele, F., Fernside, Rangiora (Line A)	3	..	1½
Steele, F., Fernside, Rangiora (Line B)	3	..	3
Steele, F., Fernside, Rangiora (Line C)	4	..	1
Thomas, S., West Belt, Rangiora	3	..	3
Commercial Seed—			
Court, R. T., Swannanoa, R.M.D. (Line C)	6	..	5
Frost, S. W., Kaiapoi, R.M.D.	6	..	4
Randall, J., Koromiko, Marlborough	6	0·4	1
Rich, A. J., Kaiapoi, R.M.D.	5	..	6
Roper, R. S., Halkett, R.M.D.	6	1·7	3

LIST OF GROWERS—*continued.*

Name and Address	Group No.	Percentage of Foreign Varieties.	Area in Acres.
EARLY ROSE.			
Mother Seed—			
Basher, W. F., care of F. E. Larcombe, Springston, R.M.D. (Line A)	3	..	1
Burns, R. A. C., Te Pirita, R.M.D., Rakaia	3	..	8
Caldwell, G., Courtenay, R.M.D.	2	..	2
McCoy, J., Te Pirita, R.M.D., Rakaia	2	..	4
McCoy, R. J., Te Pirita, R.M.D., Rakaia	2	..	4
Penn, T. A., 154 Innes Road, Christchurch	2	..	1
Shellock, W., Te Pirita, R.M.D., Rakaia	2	..	5
Weaver, J., care of A. Weaver, Te Pirita, R.M.D., Rakaia ..	3	..	3
Commercial Seed—			
Basher, W. F., care of F. E. Larcombe, Springston, R.M.D. (Line B)	5	..	1
EPICURE			
Mother Seed—			
Burgess, D., West Plains, Invercargill	4	..	1
Marshall, D., Killinchy, Leeston, R.M.D. (Line A) ..	4	..	2
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch ..	5	..	1
Shellock, W., Te Pirita, R.M.D., Rakaia	3	..	5
Shillitto, R. S., 135 Armagh Street, Christchurch ..	4	..	2
Wright, L. T., Annat	4	..	2
Commercial Seed—			
Campbell, D., King Street, Rangiora (Line A)	6	..	1½
Campbell, D., King Street, Rangiora (Line B)	7	..	4
JERSEY BENNES.			
Mother Seed—			
Burgess, D., West Plains, Invercargill	3	..	2
Milburn, M., Wright's Bush, R.M.D., Invercargill ..	4	..	1
Miller, R., East Taieri	3	..	1
Penn, T. A., 154 Innes Road, Christchurch (Line A) ..	4	..	2
Penn, T. A., 154 Innes Road, Christchurch (Line B) ..	3	..	1
Commercial Seed—			
Craig, G. H., Mosgiel	6	..	1
MAJESTIC.			
Mother Seed—			
Caldwell, G., Courtenay, R.M.D.	5	..	1
Cross, H. E., Sandy Knolls	4	..	2
Crozier, W. J., Mount Hutt, R.M.D., Rakaia	5	..	2
Oakley, J. T., Eiffelton, R.M.D.	4	..	2
Oakley, W., Halkett, R.M.D.	5	..	1
Penn, T. A., 154 Innes Road, Christchurch	6	..	3
EARLY REGENT BOLTER.			
Mother Seed—			
McLennan, C., Courtenay, R.M.D.	5	..	4
Oakley, W., Halkett, R.M.D.	4	..	9
Pascoe, S., Halkett, R.M.D.	4	..	9
Commercial Seed—			
Oakley, J. T., Eiffelton, R.M.D.	7	..	4
AMERICAN WONDER.			
Mother Seed—			
Franks, L. J., 88 Russley Road, Christchurch	5	..	1½
Wright, L. T., Annat	5	..	2

LIST OF GROWERS—*continued*.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
GREAT SCOT.			
Mother Seed—			
Wright, L T, Annat	3	..	4
Wright, Q. A, Annat	4	..	1
IRON DUKE			
Commercial Seed—			
Guy Bros, Rangiora, Springbank, R.M D. . ..	8	0 3	40
Penn, T. A, 154 Innes Road, Christchurch	8	..	2
ARRAN CONSUL			
Mother Seed			
Piner, E, Annat, R M D	3	1·0	3
BRESEE'S PROLIFIC			
Mother Seed—			
Marshall, D, Killinchy, Leeston, R M D.	6	0·3	10
INVERNESS FAVOURITE			
Mother Seed			
Piner, E, Annat, R M D	2	.	7
ROBIN ADAIR			
Commercial Seed			
Robinson, R G, Ltd, Box 4, Papanui, Christchurch ..	9	..	2
SIR J G WILSON			
Mother Seed			
Robinson, R G, Ltd, Box 4, Papanui, Christchurch ..	2	..	2

—*Fields Division*

FIFTH SCIENCE CONGRESS.

THE papers to be considered in the Agriculture Section of the Fifth Science Congress taking place in Dunedin from 27th to 30th May include the following (names of contributors are given in parentheses) Presidential address, Soil Surveys. Their Importance to New Zealand Agriculture (T Rigg, M A, M Sc), The Phosphate Status of Ashburton Soils (Miss E B Kidson, M Sc), Some Problems in Wheat Research (F W. Hilgendorf, M A, D Sc); The Biological Control of Forest Insects (A. F Clark), Enterotoxæmia and the Clostridium Welchii Group, with special reference to so called "Pulpy Kidney" of Lambs (D. A Gill, M.R C V.S, D V.S.M); Health of Domestic Live-stock of New Zealand (C S M. Hopkirk, D V Sc); Dietary Protein in Relation to Sterility (I J Cunningham, M.Sc., Ph D, and C. S. M Hopkirk, D.V Sc.); Some Dietary and other Factors associated with Epidemiology of Enterotoxæmia (Pulpy Kidney) of Young Lambs (A. Leslie, F.R C V S.), Live Weight of Pregnant Ewes in Health and Disease (A. Leslie, F.R.C V S., and J. W. McLean, B Sc Agric.); Irrigation on the Canterbury Farm, with special reference to Management (A H Flay, B Sc, M.Agr Sc), Preliminary Irrigation Investigations in Mid-Canterbury (R L. James, B Sc., A A.S E. (Civil)); Soil Survey in Relation to Irrigation (L. I. Grange, M.Sc., F.G S); The Manurial Treatment of Apple-trees (T. Rigg, M A., M.Sc); Studies on Apple Fruit Development (Dr. H. O. Askew), Farm Management Studies (G. A. Holmes, M.Sc., B.Agric.); Additional Facts relating to the Genetical Analysis of the Classical Example of Mendelian Inheritance. Smooth Seeded X Wrinkled Seeded in *Pisum* (*J. W. Hadfield, H D.A.*); Recent Developments of Pasture Investigations in New Zealand (A H. Cockayne); Pedigree Seed-production in Herbage Plants (E. Bruce Levy, B Sc).

SEASONAL NOTES.

THE FARM.

Feed Utilization.

DURING recent years, because of misconceptions about the relative feeding-values of such materials as hay, silage, and roots, some gross mistakes in the feeding of stock have occurred. A number of these mistakes have arisen because of attributing to silage a much greater feeding-value than actually characterizes it—at times it has been looked upon as a concentrate akin to linseed or to grains of cereal crops and their products, whereas silage, as usually made, approximates a coarse fodder or a roughage. Some guidance in the feeding of silage is provided from the fact that generally 1 lb. of silage equals in feeding-value 2 lb. of roots, and 1 lb. of good, average hay is equal in feeding-value to from 2 lb. to 2½ lb. of silage. Both the above statements are indicative only of approximate values, for they are subject to the important reservation that both hay and silage vary greatly in feeding-value according to variations in a series of factors. It is known fairly well that there is a multitude of differences in the feeding-value of hays. A common cause of these differences is variations in the kinds of plants in the hay and in the proportions of specific kinds present. Another cause of differences, at times substantial, in the feeding-value of hays is the time of cutting. Immature, leafy growth makes the best hay, and despite this, farmers at times, because of considering the weather or the bulk of the crop, leave the hay uncut so long that they obtain a stemmy crop which, though heavier, is of less feeding-value than a well-made, immature crop, obtainable by earlier cutting A further cause of differences in the feeding-value of hays, especially grassland hays, is the manurial treatment of the soil, which operates not only directly upon the composition of individual kinds of plants in the hay crop, but also indirectly upon the proportion of the various kinds of plants— *e g*, phosphates may increase clovers On account of its double action the influence of manuring may affect greatly the feeding-value of hay. The weather conditions during saving affects the quality of hay to a much greater extent than many farmers realize—where there is much rain during hay-making the feeding-value may be reduced to about half. All these factors already specified as causes of variation in the quality of hay, except weathering, which does not affect silage so greatly, may equally affect silage. This is because the feeding-value of silage, like that of hay, depends primarily upon the character of the crop from which the silage is made. By no means is ensilage a magical process of turning poor herbage into nutritious material. Actually the best result, that reasonably may be expected, as a rule, is that the silage will be only slightly less nutritious than the crop from which it was made. Sometimes it is substantially less nutritious. This brings up the fact that both in hay-making and in ensilage the changes which occur in the stored material may be of moment. As a rule, in hay, heating is not desired—where it takes place to any considerable extent it may be associated with combustion or with the production of moulds. Suitable heating to a slight extent is considered desirable, being known as "sweating," which produces a slight aroma in the hay and causes the stacks to settle down more firmly and thereby lessens any tendency to excessive drying should the hay be left in the stack over a long period. A practical difficulty arises in securing exactly the condition which will result in "sweating" and not bring about the excessive heating which should be avoided.

While the changes in the material being made into hay are of some moment, those in the material of silage are of prime importance, firstly because the production of brownish to almost black silage which is associated with excessive heating involves an appreciable decline in digestibility and nutritive value in comparison with the production of the greenish or yellow silage resulting from lower temperatures, and secondly because the liquid which at times drains from silage contains soluble material of distinct nutritive value—the loss of nutriment in liquid form from silage increases with the succulence of the herbage, and the loss may be made still greater when the internal moisture of the herbage is supplemented by external moisture due to wet weather at time of saving the silage.

To sum up, the feeding-value of both hay and silage varies with the botanical composition of the herbage, the stage of maturity of the herbage, the manurial treatment of the soil, the amount of weathering of the material, and the changes during curing Hence it is clear that the feeding-value of hay and of silage varies from season to season and from field to field, and indeed there may be substantial variations in the material from different parts of the one field in the same season. Consequently only experience will enable the individual farmer to determine wisely how to use the hay or silage at hand. However, after allowance has been made for the variations just considered, hay and silage as commonly made may be classed as coarse fodders, the essential difference between them arising from the fact that silage is a watery feed while hay is a dry one, and it is of practical importance that coarse fodders serve most usefully for maintenance instead of for production The feeding-value of ordinary hay and silage for milking-cows has been demonstrated fully and widely, but many seem not to realize that the yield of milk may be depressed by feeding either or both of these materials in excess Both normally contain a substantial amount of fibre which lowers their digestibility Fibre gives bulk, and a certain amount of bulk is necessary in the feed of farm stock generally, but the low yield of cows fed for winter milk production has at times been traced to excess of fibre arising from relatively heavy use of hay or silage. The amount of hay or silage that leads to depression of yield cannot be specified—it varies with the quality of the material and especially with the steminess of the original herbage, and occasionally hay or silage of a particularly leafy nature successfully has been made the dominant constituent of the winter ration of producing animals

The Feeding of Silage.

The nutritive role in which silage is of outstanding value in dairying is as a winter and spring feed for maintenance purposes.

Silage being watery is not suitable for use with other watery feeds such as roots. It is not recommended that stock be required to depend upon silage alone any more than it is recommended that other good feeds such as mangels, hay, or linseed should be fed exclusively for any extended period. Fortunately, under normal New Zealand conditions, it is not necessary to attempt to feed stock upon only silage, which generally should be used to supplement pastures just as hay and roots are used ordinarily in that way. Silage at the daily rate of in the vicinity of 100 lb. has been fed with success to dairy cows, but not often is there occasion to attempt to feed more than 40 lb. daily, for usually smaller amounts than this suffice in conjunction with the feed provided by the pastures or otherwise. Silage has been fed with good results to sheep, when used to supplement pastures, at the rate of about 2 lb. daily.

Possibly the commonest fault in the use of silage consists in underfeeding it. This fault arises primarily from attributing to it a feeding-value greater than it actually possesses and overlooking that its feeding-value approximates that of the green material from which it is made. For instance, trouble has been experienced when cows have been subsisting

almost wholly upon silage fed at the rate of from 8 lb. to 12 lb. daily, and as this amount is far below that required for mere maintenance the cows really were being semi-starved, and if this treatment were continued long enough death would follow necessarily.

The Utilization of Root Crops.

Roots generally, cereals for green feed and chou moellier, before they have declined in quality because of over-maturity all contain relatively low amounts of fibre, and so may be fed advantageously in conjunction with hay. The winter feeding of stock on roots alone is inadvisable in that it gives a ration too watery and too cold, and one likely to set up digestive disturbances. Heavy feeding of roots is particularly unsuitable for old toothless ewes if the roots are intact, and is inadvisable to any type of breeding-ewe or to dairy cattle. Roots may be supplemented suitably with dry fodder such as hay or chaff. The feeding-out of swedes on land which shortly will be sown in turnips, rape, or swedes should be avoided, as it may lead readily to contamination of the land with club-root and dry-rot organisms. In this regard interest attaches to the fact that chou moellier has been grown successfully on soil known to be contaminated heavily with the club-root organism.

On many farms the pulling and storing of mangels calls for attention in June, especially if the land occupied by the mangel is required soon for another crop, such as oats. But no rule for general application can be laid down safely: in milder districts mangels continue for a longer period to increase in weight, and it is doubtful whether it is advisable to pull such crops early in June if they are not to be used until late August or September, unless the land they occupy is especially required for another crop or likely to become so wet later that it will be difficult to cart off the crop. Mangels should be pulled in good time to allow them to ripen or mature before the stock consume them.

Many sheep-farmers are utilizing mangels successfully without storing them. Customarily, broken-mouthed ewes are turned in to eat off the tops, and the roots are then harrowed out in "breaks" some days before the sheep are given access to them. The feeding takes place relatively late in the season when the mangels, before being dislodged, have undergone a certain amount of natural ripening. Freshly pulled mangels are more subject to injury by frost than those that have been pulled for a few days, and, because of this, if at all possible, broken mild weather should be chosen for the work of pulling. When pitting is to be done, the throwing of the mangels into small heaps, covering the heaps with leaves removed from the roots and leaving them for somewhat more than a week before carting, is favoured by some as leading to better keeping of the roots in the pit.

The practice of allowing stock to fall markedly in condition before commencing the consumption of reserves of feed such as silage, hay, and roots cannot be commended. Its objective may be the possession of reserves of feed in the event of a severe late spring, an objective which, of itself, is quite commendable, but looking to the future in this way may lead to undue neglect of the current requirements of stock, especially if subject to the ravages of parasites, and in any case provision for a severe spring is better made much earlier.

Detailed information about the feeding of other materials such as chaff, grain, bran, straw, &c., to the various classes of stock may be obtained from officers of the Fields Division.

General Pasture Work.

Any top-dressing that still remains to be done before the spring should be carried out as soon as possible: a special benefit of pre-winter top-dressing is stimulation of growth before the low temperature of the soil

leads to the pasture becoming dormant until the spring Just when it becomes too late to obtain this benefit from pre-winter top-dressing varies according to geographical position, but it is certain that delay now widely is inadvisable. Although, if at all possible, top-dressing should be carried out before the most inactive period of pastures, it may be advisable at times to top-dress during this period as an alternative to inconvenience, and, possibly, inefficiency resulting from spring top-dressing being associated with an unduly heavy rush of work. The influence of phosphatic and potassic manures and of lime applied in the dormant season is not lost, but is merely delayed until the warmth necessary for growth returns. But the position in regard to soluble nitrogenous manures seems very different judging from field experience, which indicates that if conditions unfavourable for growth obtain for any considerable time after the application of such manures their influence is much lessened.

When possible, hay, silage, and roots should be fed out on pastures showing evidence of current ravages of the grass-grub: surviving plants benefit from the consequent additional trampling, and some resowing of seeds contained in the hay may occur to assist in thickening opened swards.

In many districts of relatively mild climates pastures, especially ones containing a substantial amount of rye-grass, if closed towards the end of May or in early June will provide valuable fresh feed in late July and August. The amount of such feed may be increased by the use of a nitrogenous manure such as sulphate of ammonia, from which the results are best when used in conjunction with phosphates and often lime also, while comparatively poor results are likely to be obtained from sulphate of ammonia alone. The desirability of such nitrogenous top-dressing depends largely upon a shortage of feed in late winter or spring.

General Cropping.

At this season it is of practical importance that one of the main factors limiting yields of crops is insufficient tillage, particularly before and also after the sowing of the seed. Under many conditions it would be well to begin straight away preparatory cultivation for such crops as mangels, potatoes, and lucerne. In that preparatory cultivation the two deep ploughings that are sometimes recommended are not always advisable—the surface layers of old swards may contain large numbers of weeds and of their seeds. A first deep ploughing will bury many of these which a second deep ploughing will bring back to the surface, where they readily give trouble, whereas if buried deeply enough the seeds at least cause no trouble. Often the necessary seed-bed can be obtained by skim-ploughing and disking well ahead of sowing, thus pulverizing the surface soil which later is turned down deeply by a full ploughing. In order to place the weed-infested surface layer well underground the use of a skimmer attachment is at times of value.

When the soil is not too wet and cold, oats and barley may at times be sown with success in June to provide useful spring feed. Such crops usually respond profitably to a dressing of from 1 cwt. to 2 cwt. an acre of superphosphate, and should not be drilled deeply. Treatment of seed against parasites such as smut is as desirable as for the seed of cereal crops sown earlier.

When being broken up for arable cropping "twitchy" old pastures should be utilized in a different manner from old pastures which are not "twitchy." Information about this is available from officers of the Fields Division, and is contained in these notes in the May, 1934, *Journal.*

Drainage and the provision of pits and trenches for ensilage offer scope for valuable winter work on many farms.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Pruning Operations.

At this period of the year pruning will have commenced or is about to commence in most orchards, and should be completed, if possible, while the trees are still in a dormant state. This work requires the utmost skill if the best results are to be obtained, and should be undertaken only by experienced persons. Beginners wishing to become qualified pruners should be kept under constant supervision.

The principal object of pruning is to develop and maintain a healthy tree capable of producing a heavy annual crop of first-grade fruit throughout long life. For the first four or five years after planting the aim should be to develop a strong framework capable of supporting a heavy crop. For the next few years, while the tree continues to develop, an endeavour should be made to induce fruit-production. Once these results have been accomplished, the object is to maintain good growth, avoid over-production, and effect the suppression of all undesirable growth.

The response to pruning made by trees in different conditions of soil and climate is extremely varied, and even a greater variance is to be expected with different classes of fruit and even with different varieties of the same class. It is therefore quite impossible to describe any detailed system of pruning that can be expected to give satisfactory results under all conditions. In pruning for tree-formation the operator must bear in mind the importance of developing very strong leaders, without which the tree will be unable to support heavy crops. The number of leaders will vary from three to about nine, according to the system of pruning to be followed These leaders or main limbs should be arranged spirally around the trunk, giving the tree an open centre. At the time of planting three leaders is ample, and these should be shortened back to about 1 ft. from the trunk of the tree. The foregoing remarks refer to apple, pear, quince, plum, apricot, peach, and nectarine.

As the age of the tree increases, so must the pruning treatment be varied according to the class of fruit-tree, variety, tree-vigour, &c It is impossible here to explain all or even one of these many systems To be a successful pruner it is essential that the operator should be able to foretell the subsequent growth that will develop as a result of each cut made This knowledge can best be obtained by careful observations on the various varieties. Novices in pruning will be helped appreciably in their operations by a full realization of the following facts: (1) Peach and nectarine trees bear fruit on one-year-old wood only; (2) Japanese plums bear fruit on one-year-old wood and older; (3) apples, pears, and quinces are borne on two-year-old and older and on the tips of one-year-old wood; (4) European plums produce fruit on two-year-old wood and older; (5) apricots produce fruit on one-year-old wood and on spurs produced on older wood; (6) the more a shoot approaches a vertical position the stronger is the growth; (7) the more a shoot approaches a horizontal position the more its vigour diminishes; (8) the topmost shoots absorb most sap and outgrow those below; (9) retarding the sap-flow operates against vigorous growth, and, as a result, fruit-buds are more likely to develop; (10) severe pruning increases the sap-flow, which in turn induces vigorous wood-growth unfavourable for fruit-bud development; (11) the vigour of a tree or of a shoot is dependent on the leaf surface upon it.

There has been a radical change in recent years in many commercial orchards in this and other countries in the system of pruning many varieties of apple and pear trees, and to a less extent of stone-fruit

trees. This change involves a method commonly referred to as "long pruning." With vigorous-growing trees and with certain varieties "long-pruning" appears to be preferable to many of the older styles of pruning. The system provides for a maximum of five leaders. In the case of pome-fruit, when the trees are firmly established (one or two years after planting), the leaders are allowed to grow unchecked until the tree has attained the desired height and thereafter pruned to an upright lateral growth. The production of fruiting-arms and lateral growth along the entire length of the leaders is encouraged by preventing fruit setting directly on the leaders until the desired result has been secured. Persons desiring further information regarding this or any other system of pruning should seek the advice of their district Orchard Instructor.

Tree-wound Treatment.

When it is necessary to employ a saw for the removal of large branches, the resultant wound is jagged, and, if left untreated, the cambium layer is prevented from forming callus to heal over the wound. Such unhealed wounds permit the entrance of pests (such as woolly aphis) and diseases (such as silver-leaf). Decay is also liable to set in. To treat such wounds it is advisable to trim carefully the edges of the bark with a sharp knife, leaving a finish with a bevelled edge, and to paint over with coal-tar as soon after the wound has been made as is possible.

Cultivation and Manuring.

The winter ploughing should be undertaken as soon as the foliage has fallen and the cover-crop has reached the flowering stage. Where phosphatic or potassic fertilizers are being used, these should be sown just prior to this, the deepest ploughing of the year, and thereby deposited as close to the roots of the tree as is possible The ground should be ploughed up to the trees, leaving the finishing furrows midway between the rows to act as a temporary surface drain. To reduce the danger of injuring tree-roots while ploughing, it is a good practice to set the plough to a depth of about 3 in. for the striking-out furrow and increase the depth every second or third furrow so that the finishing furrow will be about 6 in. or 7 in deep

—*P. Everett, Orchard Instructor, Gisborne*

Citrus Notes.

The copious rains following the long dry spell during the summer months have caused much late succulent growth to appear, and this in a number of localities will not have had time to harden before the danger of frost appears. In those localities where frost is common some means of raising the temperature above the danger-point should be adopted.

The time is now approaching when the harvesting of citrus fruits will be undertaken. Lemons should be cut when they have attained the size of from $2\frac{1}{4}$ in. to $2\frac{1}{2}$ in., regardless of colour, and then stored and cured to make them ready for marketing. Poorman oranges should be allowed to remain on the trees until they are sufficiently matured to make good breakfast fruit. The practice of picking them green and completing the process of ripening by artificial means is not to be recommended. It is in the encouragement of the consumption of this orange as a breakfast fruit that an increase in the sales can be sought. Sweet oranges should be left to reach maturity on the trees, otherwise the fruits will not have attained sufficient flavour to command attention.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

The Breeding-hens.

ALTHOUGH it will be several weeks yet before breeding and hatching operations actually commence, it is full time these operations were planned, for it is always advisable to have everything in readiness if success is to be assured. Generally, hatching operations will not commence before July. Pullets of the heavier breeds hatched then may be expected to commence laying in the following autumn on the rising egg-market. This being so, preparations for this important work should be put in hand now. The breeding-birds at this time should receive the most careful treatment, and it should be unnecessary to emphasize that, if vigorous and profitable stock are to be bred, it can only come from parents of sound constitution in perfect health and condition at the time of mating.

Special attention should be directed to the feeding of the prospective breeding-hens, which should be well fed, but not over fed. Every effort should be made to prevent the birds becoming in an overfat condition during the moulting period or just before eggs are required for hatching purposes, as eggs containing strong germs, and giving chickens that are easy to rear, are seldom or never produced from an overfat hen. The birds should be handled frequently and if there is a tendency for them to put on surplus fat the ration should be reduced slightly. They should also be encouraged to exercise as much as possible. If the breeding-birds are to be maintained in their best vigour, and be capable of producing eggs with the desired strength of germ, they should have a free range, or at any rate ample space for exercise affording some semblance to the condition their nature demands. In a general way the coddled bird is not the ideal specimen to breed from for the maintenance of a flock characterized by heavy production.

It is always good practice to choose for the breeding-pen a hen slightly larger than that desired in a laying flock, or larger even than one suitable for entry in an egg-laying competition. A certain percentage of small birds will come willy-nilly without specially breeding for them. Unfortunately, too many poultry-keepers consider that because small birds are often good layers they must necessarily be desirable specimens for the breeding-pen. This is a great mistake, and the less breeders act upon it the better will it be for the individual poultry-keeper's pocket and the industry generally, while, furthermore, less would be heard of persistent requests to unload small-sized eggs on to the London market. It should be remembered that, as a general rule, the diminutive hen produces a small low-grade egg. No hen should be placed in the breeding-pen which does not produce a standard egg—namely, one of 2 oz.

Litter.

A question frequently asked is how to prevent the litter in the fowl-house piling up under the dropping-boards and perches. This accumulation is due to the fact that the birds, when scratching for food in the litter, always work with their heads towards the light, hence, as the litter is daily scratched back, it necessarily follows that it soon becomes piled up at the back of the house. No doubt if light were provided by means of glass frames being placed low down in the back wall of the house the trouble would be minimized. It is a question, however, whether the expense of doing this is warranted, as, after all, it is not a big job frequently to spread the litter with a fork, and from all standpoints this regular spreading of litter will have a beneficial effect.

Determination of Age of Ducks.

Really there are no physical signs to determine with certitude the age of a duck. The condition of the windpipe, however, is a good guide as to whether a bird is old or young. If the windpipe is hard to the touch, it is safe to say the bird has passed the duckling stage. On the other hand, if the windpipe is soft and yields to the touch it indicates that the bird is comparatively young. In applying this test with a live bird care must be taken that the windpipe is not squeezed to the extent of injuring the bird. With a dead duck the condition of the upper part of the bill gives a good indication of age. In a young bird the bill can be pressed back and easily broken, while with an old one it will be found difficult to do this unless great pressure is used. Another way of deciding between an old and a young bird is the manner in which the breast bone can be pierced with, say, a sharp hat pin. With a young bird the bone can be pierced with but little pressure, but in the case of an old one the bone is harder and offers more resistance

Fowls sleeping in the Nests.

It is common for fowls, particularly when undergoing the moulting process, to acquire the habit of sleeping in the nests and not on the perches. No doubt the chief reason for this is that being incompletely feathered the birds feel the cold, and resort to the nests, which provide a warmer sleeping-place than the perches. It is a habit, however, which should be broken at the earliest possible moment, for the reason that it not only encourages the presence of insect pests, particularly the red-mite, but in addition the eggs cannot be gathered in a clean state. The red-mite—probably the worst enemy of domestic fowls in this country—usually makes its first appearance on the perches, or, of course, any other place where the birds rest at night It is a simple matter to deal with the mite when its presence is confined to the perches, by having the ends of the latter arranged in such a way that they or the birds' feathers do not touch the walls of the house and by giving the perches frequent treatment with a strong disinfectant or with kerosene. It is not so simple, however, when the mite once gets a good foothold in the nesting quarters, for from these it may soon spread to hiding-places in the walls, and when this happens it is difficult to tell when the pest will be stamped out

Once birds take to sleeping in the nest the only practical way of breaking the habit is to place an obstruction in front so as to prevent them from entering. A board placed in front of the nests, or a piece of wire netting arranged in such a way as to be easily put up or taken down, will serve the purpose. The obstruction should be placed in position before roosting-time, and removed first thing in the morning to allow the birds to lay in the nests. Obviously some work is entailed in keeping the birds out of the nests by night, but in most cases this will prove a mere trifle compared with the labour of washing soiled eggs and clearing up vermin-infected quarters.

Pullets moulting.

Several poultry-keepers have asked for advice on, and are at a loss to account for, pullets hatched at the right time going into a moult just when it was thought they had settled down to a prolific winter laying-season. Without seeing the birds or making a close examination, in each case, of the methods of management from the shell to maturity it is a difficult matter to account for such disappointment. There are so many factors responsible for pullets going into a moult at this period of the year that it becomes necessary to search among several possible causes. Especially does this apply in these days when there are so many new ideas on feeding poultry by cheap substitutes and

prepared mixtures allegedly without interfering with the egg-supply. The important subject of reducing the cost of production, when the pullet bred to lay in winter is concerned, is one that should be approached with the utmost care, as obviously when the pullets settle down to egg-production a greater supply of food is required than before the laying period commenced. Reducing the food-supply and repeatedly testing new systems of feeding are common causes of postponement of the commencement of the laying period, also of false moults after laying has started, and a consequent poor egg-supply. A very common mistake is to think that all grain is alike, and that cheap defective wheat, low-grade oats and barley, &c., are economical. The food-value of these is almost invariably in ratio to their cost, and it is generally the case that the best grades of grain are the cheapest in the end, for the bird if given all the green stuff and meat, or its substitutes, desired will satisfy itself with a much smaller proportion of grain of good quality than it will with grain of low grade. The waste also is considerably less than with grain of poorer quality: indeed, cheap grain for poultry is false economy in its worst form. Quality rather than quantity should always be the objective in deciding on the ration for the layer. This is not to infer that the cost of feeding fowls should not be reduced to a minimum, providing of course the birds' health and their production are not interfered with in the process. Probably the one way open to the average poultry-keeper to reduce the cost of feeding lies in the direction of supplying good green food in abundance. In any case, this suggested lowering of feeding-costs is much more easily accomplished in the warmer months of the year—*i.e.*, the fowls' natural laying-season In the case of some poor egg returns, and judging by the inferior samples of pollard that have come under my notice, it is not surprising that the pullets went into a moult and ceased to lay: indeed it would have been surprising had they not.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Care of Hives.

At no other season is the welfare of the colonies of such importance as during the next few months Every hive should be raised from the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This tends to keep them free from slaters (wood-lice) and other insects, and affords less harbour for mice, as well as ensures a free current of air beneath the bottom-boards, which are thus more likely to keep dry. The bottom-boards should never be rested on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be canted slightly forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when

frost sets in. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more obnoxious than does their owner. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should cover them with either zinc, ruberoid, or some other waterproof material. If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

Removing Spare Supers.

As advised last month, all top boxes not actually occupied should be removed and the bees made as snug as possible. If the colonies have been cared for well, and are headed by good queens, they will need at least one top box in addition to the brood-chamber, which will be fairly crowded with young bees bred since the close of the main honey-flow These are colonies that the beekeeper should strive to have, as they will come out strong in the spring and give the best returns when the next season's honey-flow arrives. In removing supers at this time every care must be exercised to avoid robbing. There will be bees in the supers to be removed, and these can be got rid of by using bee-escapes. By putting these on in the evening the supers will be clear of bees in the morning, providing there is no brood in the combs. All operations at this period should be carried out as expeditiously as possible so as not to attract robber bees, which are much in evidence during the warm hours of the autumn days.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Pruning Hardwood Plants.

TREES and shrubs that are highly trained often have the new growth thinned and shortened during the summer , but the main pruning-season, especially where older wood has to be removed, is the winter, and towards the end of that season for evergreen and for deciduous plants liable to injury by late spring frosts. To obtain good results, whether one is growing the plants for timber, shelter, shade, fruit, or display, &c., this highly important operation requires careful consideration and execution. Premature decay in a tree frequently is set up by snags, formed when pruning, dying back into the heart of the tree. This can be avoided by cutting the branches off flush at the base when it is necessary to remove them. If they are of any size an under-cut, before the cut from above which completely severs the limb, will prevent the sap-wood and bark making an ugly tear when the limb falls. The wound then should be coated with tar or thick paint to keep out water and decay, which it will do effectually if the coating is renewed as required until the wound has healed. If it is not desirable to cut a branch out completely, it is usually quite satisfactory to make a clean cut through the branch just beyond a lateral growth or a well-developed bud If attention were paid to these few rules the trees on the majority of farms would be in a much better condition.

When trees or shrubs are planted out it is desirable that they should branch out vigorously a little above the surface of the ground or higher ; or possibly it is desired to grow a straight trunk without large limbs—in other words, assume some definite shape. For whatever plan is favoured, the training should commence in the pruning-season when the plants are two or three years old. Each tree should be looked over annually at that season for a few years, and given such pruning as may be required to carry

out the design. It then probably will make a very satisfactory plant and require little attention afterwards. The main features to be watched at this stage and modified by means of pruning are shape, balance, and vigor.

Where plants of moderate to large size are being shifted, especially where the roots have been considerably reduced, the tops should be thinned and shortened so that they may not suffer during the summer from the restricted supply of sap from the root.

Pruning and training Small Fruits.

Established plantations of raspberries, loganberries, and black currants, which produce their fruit on the growth of the previous season, are usually pruned immediately after the harvest, and the old wood is carried out and burnt, thus removing the danger of propagating diseases and pests, and allowing the new growth to ripen. If this has been omitted it may be done now by cutting away at the ground surface the canes of raspberry and loganberry that have borne fruit, and removing the unripe ends of the young canes retained for fruiting next season. The old wood in black currant bushes is cut back to a bud at its base, and if weak new growth, which is unlikely to carry fruit next season, is also treated in the same manner it will tend to encourage that vigor in the plant which is an advantage with this type Gooseberry plants also may be treated in this manner, although some growers like to shorten the new growth to a few buds only in each case. In the case of red currants we have plants which decidedly carry the fruit on spurs on the old wood. The method here is to suppress suckers, to which red currants are very prone, retaining only perhaps a growth here and there to take the place of leading growth which has become exhausted and has to be removed Then it is advisable to look over the spurs borne by the permanent frame-work of the plant and thin out, invigorate, or check them as may be necessary. As a rule those at the base of the plant require to be invigorated to some extent by cutting them back to wood buds.

To obtain good results the pruning should be followed up now by applying a good dressing of old farm manure, liquid or solid (the former is the richer in plant foods), and working the ground only to a depth sufficient to suppress weed growth—such working avoids injuring the fibrous roots of the plants.

On good land, and with every attention, heavy crops of these berries cannot be borne indefinitely, so that replanting probably will be necessary after a period of eight to ten years. If a new plantation is set out on fresh land that has been carefully prepared it can be brought into bearing before the old one is grubbed out. The pruning policy in the case of young plants is to encourage vigorous growth on an approved plan. Raspberries and loganberries may be cut back to about 6 in. from the surface of the ground , no shaping need be considered as all new growth springs from the roots annually. Black currants are cut back to make them stool out vigorously ; but little shaping is necessary, as less air and light than usual are required to make these plants fruitful. Gooseberry and currant bushes (red and white) have quite different habits in that abundant air and light are necessary to develop the buds. Any sucker-growth must be suppressed vigorously, and the bush trained up from the one main stem in a way that will make most of the available space, except that the centre remains open : usually training is commenced by retaining three well-placed branches the first year and cutting them back now to carefully selected buds with a view to producing strong, well-balanced forks.

The Homestead Garden.

The good appearance of the homestead garden depends less upon its ornamental character than it does on the general well-being of the trees and shrubs which compose its main features. To develop this well-being and maintain it afterwards a certain amount of supervision is always necessary.

In this probably nothing will be so important as a little pruning at the right season for the purpose of directing growth and making good any injury that may have been caused by accident.

For a shelter-belt to be effective special care is necessary to keep the base well furnished. This can be done only by keeping down all rank herbage which lessens the supply of light and air necessary to maintain the condition of the foliage on those parts. In varying degree, but to some extent for all plants, and all parts of them that we would keep furnished, light and air are as necessary as earth and water. Once foliage is lost it is most difficult to replace. If the base consists of barberry, boxthorn, or other stock-proof hedge plant, it will be sufficient to give it periodical trimming in addition to suppressing rank growth from the ground: any other plant will require also to be fenced securely from stock which would otherwise seriously injure it by rubbing, if not by eating, the lower branches. In the case of shelter trees it may be advisable to do topping, to remove broken or dead limbs, or to cut out unbalanced growth. If this is done in the manner described in the opening remarks there will be rapid improvement and little danger from disease or decay. If the locality is dry these trimmings should be carried out and chopped up for use, as they may start a fire if left in the plantation; in wetter districts, with the exception of the heavier sticks, the litter often makes a useful mulch. With such attentions a shelter-belt of trees will look well and give good service if a suitable selection of healthy trees has been planted.

In the shrubbery borders winter pruning will largely consist of cutting back the growth of over-vigorous subjects inclined to overgrow weaker plants, often of better quality. If the branches for removal are cut just beyond a lateral of moderate growth it will usually have the desired effect, so long as the lateral is not shortened, and the appearance will be natural with very little disfigurement.

It is also customary to prune some of the choicer flowering shrubs and climbers such as roses, hydrangeas, &c. In dealing with this section it is first necessary to ascertain on what part of the plant the flowers are borne. For instance, most kinds of roses and hydrangeas bear the flowers on the new wood; while many early flowering shrubs such as Forsythia and Diervilla carry the blossom on young wood produced the previous season, others again such as Wistaria and species of *Pyrus* carry them chiefly on the older wood and spurs. With this information pruning can be done intelligently, although one must always be careful to cater for the peculiarities of the different species and even different varieties. The study, however, is well repaid, for in most instances no other operation has equal effect in producing satisfactory results. The cardinal principle of avoiding congested growth in hardwood plants must always be observed. A plant looks its best when well furnished, but if the growth is crowded and insufficient light and air is admitted to certain parts, the flower-buds there will be destroyed and possibly growth and foliage also. This training is best commenced in the manner before described when the young plant is first set out.

No feature perhaps requires this careful training more than a garden hedge. It naturally is a prominent feature, and if an even grade of plants is lined out in well-prepared land of even quality the result will be, if properly trained, a handsome contribution to that well-managed appearance that is a decided asset on a property. Where a rather high cypress hedge is to be grown the natural habit of the plant facilitates the work; as it habitually forms abundant breast wood it can be grown to the required height before being stopped by pruning. Where a second leader appears in a plant it should be removed, and the foliage at the base of the hedge carefully preserved by preventing the competition of long grass, and avoid undercutting which will cause the upper portion of the face to lean outward in the slightest degree. It is, however, with ordinary evergreens

such as Escallonia and Coprosma that most difficulties are met; and this chiefly by hurrying the growth upwards before sufficient lateral growth, which it is found almost impossible to obtain later, has been made. For the first year or two the object should be to provide a strong wide base, after which the necessary height is added quickly and easily. The method is to thin out the leading wood in the young plants to a few vigorous growths and shorten them by hard pruning to induce strong hard laterals. It requires a little courage to do this for a season or two, but the rapid growth later will catch up those hedges grown by less commendable methods. If the base is kept wider than the top, and regular trimming is maintained, it will always look well and give good service.

Hedges and shrubberies carry their roots so near the surface of the ground that deep digging is not advisable once the plants are established. At this time of the year nothing suits them better than a light dressing of old manure, with the addition probably of some phosphates. Where neatness demands that the manure be turned under, it is best done now, and this not more deeply than from 3 in. to 4 in.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TAKING SUCCESSIVE CROPS OF POTATOES.

R. W. F., Ruatoria :—

Owing to scarcity of suitable ground I have grown potatoes for three successive years in what was originally virgin bush country. Last autumn was the first time I top-dressed, used 2 cwt blood and bone with 2 cwt. phosfull, and dug quite a reasonable crop considering the season. Do you think I could expect another fair crop next year if I top-dressed and ploughed twice? If so, what manure is best for potatoes?

The Fields Division :—

It is considered not good practice to take a crop of potatoes from the same land four times in succession. Potatoes always grow and yield best and are usually more healthy if taken as a maiden crop from new land or after lea. In exceptional instances, such as in the case of growers who cater for very early markets, successive crops are often taken from the same land with very heavy manuring, but in such cases neither heavy yield nor good quality is very important. Experience suggests that you cannot expect a payable fourth crop in succession from the same land. In potato-growing a manurial dressing which widely gives good results is 2 cwt. superphosphate and 2 cwt. blood and bone per acre.

CUTTING OF SEED POTATOES.

R. W. F., Ruatoria :—

Is it advisable to cut big potato-seed? If so, should the cut surfaces be sun dried, or kept moist before planting?

The Fields Division :—

It would certainly be more economical to cut very large potatoes for seed, but there is no necessity nor is it wise to cut seed that conforms to the size of a hen's egg. If you decide to cut your large seed, you should plant the cut seed *immediately it is cut* without any attempt at drying the cut surfaces.

WEATHER RECORDS: APRIL, 1935.

Dominion Meteorological Office.

NOTES FOR APRIL.

APRIL was a very mild month with comparatively little stormy weather. The rainfall was irregularly distributed, some districts having much more and some much less than the average. There were, however, few places in which a shortage of moisture gave trouble. There was exceptionally good growth of grass for the time of year, and the country looks very green. The milk-yield has been well maintained, and stock are in good condition. Some facial eczema amongst sheep is still reported from Poverty Bay. In Canterbury and a few localities on the east coast of the North Island where there was a good deal of cloudy weather the new feed is still soft, but elsewhere, particularly in the North Island, the high temperatures and ample sunshine have enabled it to harden, and in many cases the condition of pastures resembles that of a good spring month.

Rainfall.—Parts of western Taranaki and most of the Wellington Province had less than the average rain, but over practically all the remainder of the North Island there was a considerable excess. Many places in the Bay of Plenty and Hawke's Bay had more than double the average. At Napier more than three times the average was recorded

In the South Island, much of Nelson and Marlborough and parts of Southland had more than the average rainfall, but elsewhere it was a dry month Parts of South Westland and the interior had deficits of over 50 per cent.

Temperatures.—For the sixth month in succession mean temperatures were everywhere considerably above normal The departures were highest in the northern and western parts of the North Island, where they were in the neighbourhood of 3° F. In the South Island, and especially eastern districts, they were not so high. There were few frosts, and no severe ones.

Sunshine.—Sunshine was below normal in Hawke's Bay, Canterbury, and Central Otago, but above it elsewhere Nelson reports 230·8 hours, Tauranga 207·5, and New Plymouth 194·9.

Storms Systems.—The weather was slightly disturbed during the first few days of the month, and during the 3rd and 4th the passing of a westerly depression was accompanied by heavy rain in western and far southern districts

After a spell of fine weather with anticyclonic conditions ruling, there was a stormy period from the 10th to the 14th, especially over the North Island. The distribution of pressure was complicated, but towards the end of the period there was a deep and slowly moving cyclone off East Cape. At the beginning there were north-easterly gales in the Auckland Province, while at the end southerly gales blew over the North Island. Heavy rains were practically general. In many parts of the North Island there was flooding, Hawke's Bay suffering most. Some severe thunderstorms occurred, and snow fell on the mountain-tops.

The next stormy period was from the 21st to the 24th. A depression developed off the west coast of the North Island and moved eastward, only very slowly. North-easterly gales again blew in the north. Except in parts of the Wellington Province and eastern districts of the South Island, heavy rain was general. Some exceptionally heavy falls were recorded in the Waikato and Bay of Plenty districts, several places having more than 7 in. in twenty-four hours. High floods occurred in these districts, and Taranaki and North Auckland also suffered to some extent. Severe thunderstorms were reported, especially from Taranaki.

Further widespread rains occurred in connection with depressions passing between the 26th and 28th, but there were not many heavy falls The mountain-tops again received a coating of snow.

Rainfalls for April, 1935, at Representative Stations.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	0·27	13	2·12	4·42	22·61	14·96
Russell	8·36	8	4·01	4·25	37·21	13·77
Whangarei	3·80	16	1·45	4·93	27·43	17·18
Auckland	5·07	16	1·96	3·54	21·31	12·40
Hamilton	6·34	16	2·93	3·85	13·26	14·09
Rotorua	5·83	12	1·92	4·47	24·41	15·91
Kawhia	7·09	14	2·01	4·65	20·35	14·48
New Plymouth ..	6·51	15	2·47	4·60	26·54	16·30
Riversdale, Inglewood ..	7·85	14	3·16	8·11	40·80	28·69
Whangamomona ..	4·97	7	1·23	6·52	31·45	20·97
Hawera	4·50	13	1·24	3·48	21·05	12·40
Tairau	7·16	7	2·28	5·96	28·90	19·51
Tauranga	9·88	11	4·18	4·77	23·03	16·34
Maraehako Station, Opotiki	12·59	15	3·22	4·74	26·09	10·43
Gisborne	4·76	15	2·37	4·05	14·67	14·65
Taupo	4·22	8	1·25	3·60	18·48	12·85
Napier	9·33	13	2·84	2·78	16·86	11·62
Hastings	7·83	14	3·00	3·33	14·17	10·27
Whakarara Station ..	5·32	13	3·05	..	21·36	..
Taihape	1·84	14	0·48	2·79	11·30	10·79
Masterton	1·91	16	0·39	3·05	7·44	11·19
Patea	2·71	13	0·64	3·67	18·24	13·01
Wanganui	2·72	10	0·94	3·27	15·38	10·99
Foxton	1·69	9	0·54	2·50	9·59	8·69
Wellington	1·79	12	0·50	3·53	10·85	12·12
			South Island.			
Westport	6·37	14	1·43	8·25	30·54	29·30
Greymouth	7·59	13	2·14	8·48	35·62	32·66
Hokitika	8·20	13	2·62	9·33	45·65	36·23
Ross	8·25	11	2·39	12·18	40·56	44·21
Arthur's Pass.. ..	6·99	8	2·75	15·42	54·42	52·63
Okuru, South Westland	5·27	6	2·47	14·12	49·39	50·52
Collingwood	7·87	9	2·79	8·15	25·83	25·81
Nelson	3·88	7	1·26	3·11	17·65	11·46
Spring Creek, Blenheim	2·71	6	1·00	2·12	8·51	8·50
Seddon	1·92	9	0·51	1·71	6·09	7·40
Hanmer Springs ..	2·84	9	1·11	3·32	10·56	13·62
Highfield, Waiau ..	3·50	9	1·82	2·60	8·38	11·02
Gore Bay	2·10	8	0·63	2·38	7·45	9·77
Christchurch	1·40	13	0·60	1·86	4·43	7·76
Timaru	1·40	9	0·44	1·59	7·99	7·90
Lambrook Station, Fairlie	1·85	8	0·93	1·97	8·21	8·55
Benmore Station, Clearburn	1·19	6	0·60	2·40	10·42	9·20
Oamaru	1·20	11	0·37	1·79	8·17	7·40
Queenstown	2·00	6	1·12	2·98	13·81	10·45
Clyde	1·39	4	1·03	1·45	7·23	5·85
Dunedin	1·56	10	0·78	2·77	12·73	11·87
Wendon	2·29	10	1·12	2·71	14·08	10·91
Balclutha	2·01	11	0·87	2·19	12·33	8·80
Invercargill	5·47	17	1·70	4·14	19·09	15·14
Puysegur Point ..	6·91	17	1·21	7·67	30·56	29·00
Half-moon Bay ..	6·40	16	1·75	5·10	20·01	19·37

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VERTICILLIUM-WILT OF POTATOES.

ITS RELATION TO STEM-END DISCOLORATION OF THE TUBERS, AND SUGGESTED MEASURES FOR CONTROL.

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IT has been demonstrated (Chamberlain, 1935, *b.*) that verticillium-wilt, caused by *Verticillium albo-atrum*, may, under New Zealand conditions, cause a considerable reduction in the yield of potato crops. Since the disease is carried in the tubers, it is inadvisable to use for seed purposes potatoes from a heavily infected crop. The necessity therefore arises for an efficient method of determining the percentage of wilt-infection. Two methods have been suggested—(1) counts of wilted plants in the crop during the growing season, and (2) the determination, after harvesting, of the percentage of tubers showing stem-end vascular discoloration.

FIELD COUNTS FOR THE DETERMINATION OF VERTICILLIUM-WILT.

Verticillium-wilt may cause wilting of the foliage at any time throughout the growing-season, so that to obtain the most reliable results it is necessary to make the field inspection as late as possible. Even counts taken late in the season, however, do not include all infected plants, for there is always a percentage which do not show any foliage symptoms. An experiment in which field counts were taken throughout the growing-season was carried out to ascertain the correlation between field symptoms and verticillium-wilt (Table 1). Wilt-infection was determined by means of cultures prepared from the vascular system of the stems, only those plants from which *V. albo-atrum* was isolated being classed as infected. At harvest, from each plant was selected one seed-size tuber from which, later, isolations were made from the vascular tissues at the stem-end. The technique adopted has been described in a previous article (Chamberlain, 1935, *a.*).

It has been shown that all the tubers of a wilted plant do not necessarily become infected with verticillium-wilt and that the disease may be present in tubers from apparently healthy plants (Pethybridge, 1916; McKay, 1921, 1926; Chamberlain, 1935, *b.*). It is evident, therefore, that the percentage of plants showing wilt-symptoms in the field does not give an absolute measure of the amount of tuber-infection

(Tables 1 and 2). Experiments (Table 2) have also shown that there is no constant relation between the percentage of wilt in the field and the percentage of tuber-infection.

Table 1.—The Correlation between Field Symptoms and Infection by V. albo-atrum.

Appearance of Plants in the Field	Haulms.		Tubers.	
	Number.	Percentage infected.	Number.	Percentage infected.
Wilted	153	95	140	20
Slightly wilted ..	22	91	21	10
Leaves discoloured* ..	65	65	61	20
Healthy	275	11	255	9
Totals ..	515	46	477	13

* There were no symptoms of wilt on these plants and only some of the leaves were beginning to turn brown. Such plants would not be recorded as wilt-infected in field counts.

Table 2.—The Relation between Field Symptoms and Tuber-infection in Different Lines of Potatoes.

Appearance of Plants in the Field.	Aucklander Tall Top Potatoes grown at Palmerston North			
	1930–31 Season.		1931–32 Season.	
	Number of Tubers.*	Percentage Infection.	Number of Tubers.*	Percentage Infection.
Wilted	101	52	161	19
Healthy	100	18	255	9
Totals ..	201	35	416	12·5

* The tubers were seed-size, each one being selected at harvest from the progeny of individual plants marked in the field during the growing-season.

The figures in the above table show that in both seasons tuber-infection is less than field counts suggest. They also show that the percentage infection of tubers from wilted plants was much greater in the 1930–31 season than in the 1931–32 season. It is possible that the difference may be explained on the grounds that the former crop was allowed to remain in the ground for some time after the haulms had died down, while the latter crop was lifted immediately the crop was mature.

CORRELATION BETWEEN STEM-END DISCOLORATION AND VERTICILLIUM-WILT INFECTION OF THE TUBERS.

Elsewhere it would appear that there is little, if any, correlation between vascular discoloration at the stem-end of potato-tubers and the presence of wilt-producing organisms. Thus Pethybridge (1916), working with verticillium-wilt in Ireland, found that tubers might be infected with the disease, although they showed no stem-end discoloration. In North America Edson (1920), McKay (1921, 1926), and Eastham (1923) showed conclusively that the presence or absence of *V. albo-atrum* in the tubers could not be determined by the presence or absence of vascular discoloration at their stem-ends. Since the cause of vascular discoloration under New Zealand conditions was unknown, the following experiments were undertaken to determine whether there was any correlation between stem-end discoloration and verticillium-wilt infection.

The first experiments were carried out with tubers from a commercial line of Auckland Tall Top potatoes which had shown a high percentage of wilt in the field. The crop was grown, during the 1929–30 season, in the Rangiora district, and the progeny, grown the following year at Palmerston North, supplied the seed for the 1931–32 season. The other varieties were grown in various localities (Table 3). The correlation between stem-end discoloration and verticillium-wilt infection of the tubers of different lines of potatoes grown in different localities may be seen from the following table.

Table 3.—Showing Correlation between Stem-end Discoloration and Verticillium-wilt Infection of Tubers of Different Lines of Potatoes.

Variety.	Locality grown.	Year.	Extent of Stem-end Discoloration.	Number of Tubers.	Number of Tubers yielding			Percentage of Tubers yielding *V. albo-atrum.*
					Verticillium albo-atrum	Other Fungous Species.	No Growth.	
Auckland Tall Top	Rangiora ..	1929–30	Extensive	65	25	39	1	38
			Slight ..	82	8	67	7	10
			None ..	17	1	3	13	6
Auckland Tall Top	Palmerston N.	1930–31	Extensive	61	24	33	4	39
			Slight ..	79	13	42	24	16
			None	14		1	13	0
Wilted Plants. Auckland Tall Top	Palmerston N. ..	1930–31	Extensive	53	27	26	.	51
			Slight ..	47	25	19	3	53
			None ..	1	..	1		0
Healthy Plants. Auckland Tall Top	Palmerston N. ..	1930–31	Extensive	23	13	9	1	56
			Slight ..	61	5	41	15	8
			None ..	16	.	7	9	0
Wilted Plants. Auckland Tall Top	Palmerston N. ..	1931–32	Extensive	57	9	48	.	16
			Slight ..	79	19	55	5	24
			None ..	12	.	2	10	0
Healthy Plants. Auckland Tall Top	Palmerston N. ..	1931–32	Extensive	39	9	29	1	23
			Slight ..	199	25	118	56	13
			None ..	78	2	14	62	3

Table 3—continued.

Variety.	Locality grown.	Year.	Extent of Stem-end Discoloration.	Number of Tubers.	Number of Tubers yielding *Verticillium albo-atrum*.	Number of Tubers yielding Other Fungous Species.	Number of Tubers yielding No Growth.	Percentage of Tubers yielding *V. albo-atrum*.
Epicure	Palmerston N. ..	1930–31	Extensive	18	4	10	4	22
			Slight ..	136	8	59	69	6
			None ..	97	4	4	89	4
New Era ..	Ashburton ..	1930–31	Extensive	24	.	14	10	0
			Slight ..	1	.	..	1	0
			None ..	.	..	..	..	0
Wilted Plants.								
King Edward* ..	Gore .. .	1932–33	Extensive	39	1	37	1	3
			Slight ..	53	.	48	5	0
			None ..	4	.	1	3	0
Healthy Plants.								
King Edward* .	Gore	1932–33	Extensive	39	.	35	4	0
			Slight .	51	..	43	8	0
			None .	4	..	1	3	0
Wilted Plants.								
Arran Chief* ..	Gore .. .	1932–33	Extensive	33		18	15	0
			Slight .	51	.	21	30	0
			None .	12	.	.	12	0
Healthy Plants.								
Arran Chief* .	Gore .	1932–33	Extensive	28	.	17	11	0
			Slight	50	.	16	34	0
			None	19	.	1	18	0
Dakota	Weedons ..	1933–34	Extensive	4	.		4	0
			Slight ..	.		.	.	..
			None ..	..		..	..	..
Dakota	West Melton ..	1933–34	Extensive	4	.	.	4	0
			Slight ..	.	.	.	..	..
			None ..	..	..	..	.	..

* In crops of King Edward and Arran Chief potatoes grown at the Gore Experimental Farm during the 1933–34 season plants in certain areas wilted. The tubers used in this experiment were selected from wilted and healthy plants respectively. The wilting was apparently not associated with verticillium-wilt, and the progeny of the wilted plants produced a healthy crop in the following season.

A study of Table 3 shows that there is a certain amount of correlation between vascular discoloration and verticillium-wilt in some lines of potatoes. In others, however, there is no such correlation, verticillium-wilt being entirely absent from certain lines showing a high percentage of tubers with stem-end discoloration.

The New Era and Dakota potatoes showed a very distinct discoloration of the whole vascular system of the tuber (figs. 1 and 2). The progeny of the New Era potatoes when grown in Palmerston North during the 1931–32 season did not develop any vascular discoloration. In the case of the Dakota tubers from Weedons the grower stated that the trouble resulted from flooding of the field prior to harvesting. Potatoes from the same crop, harvested before flooding, showed no signs of the discoloration. This supports the view of Edson (1920) and Goss (1923)

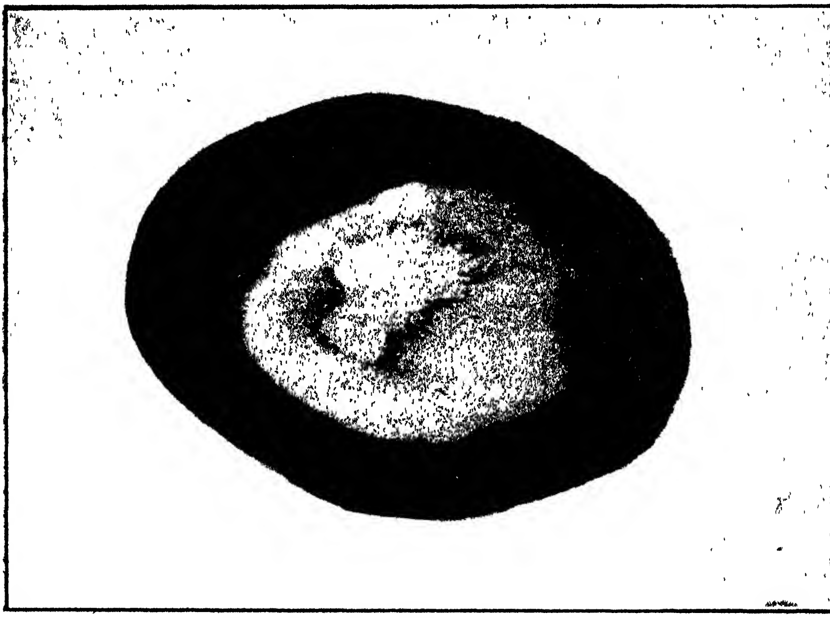

FIG. 1. VASCULAR DISCOLORATION AT STEM-END OF TUBER.
New Era potato tuber in which no fungus was associated with the discoloration.

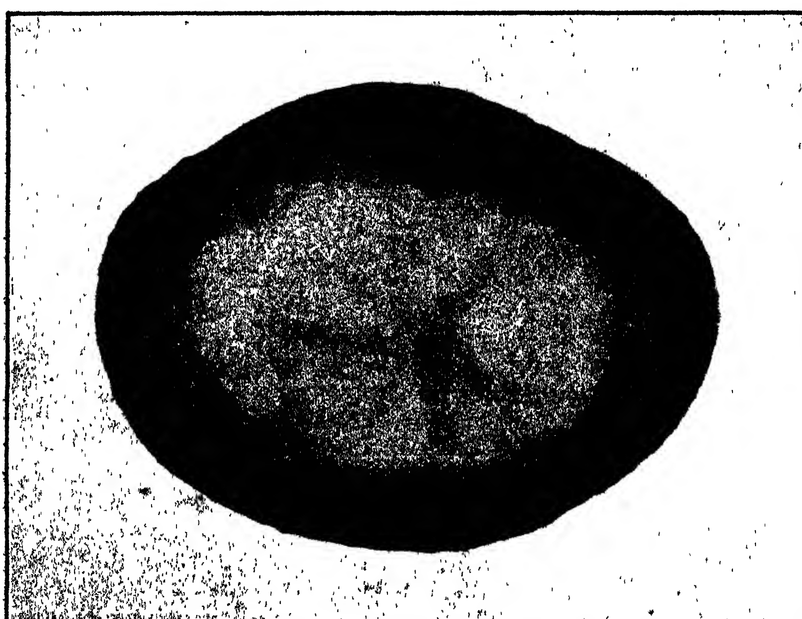

FIG. 2.—VASCULAR DISCOLORATION EXTENDING INTO TUBER.
Same tuber as in Fig. 1, cut transversely mid-way between stem and rose ends.

that vascular discoloration of tubers may in some cases be brought about by environmental conditions and is not necessarily associated with the presence of fungi.

The results given in Table 3 show that in most cases, however, fungi are associated with discoloured tissues. No specific fungus could be correlated with any particular type of discoloration. Thus *V. albo-atrum* was isolated from tubers showing dark or light brown, extensive or slight discoloration, and from tubers showing no discoloration. The same may be said of the other fungi isolated. (See fig. 3.)

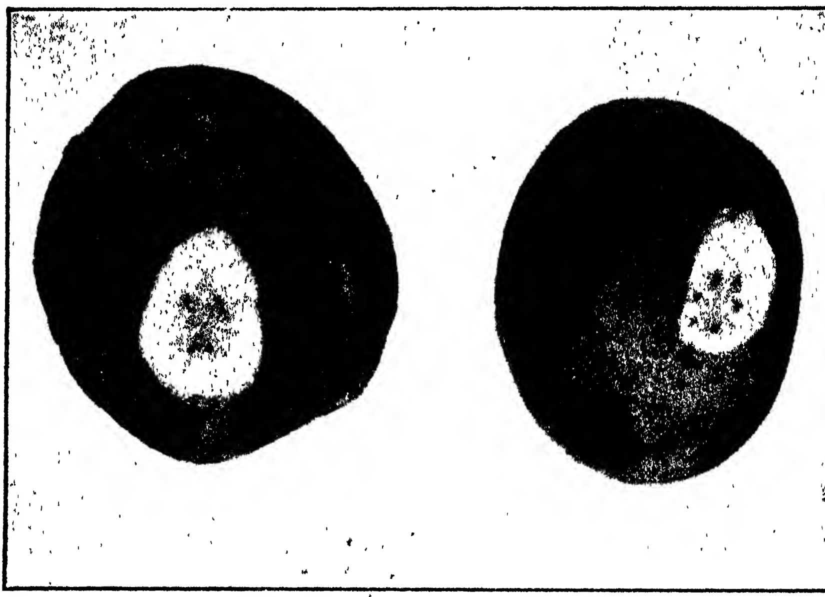

FIG 3. DIFFERENT FUNGUS SPECIES ASSOCIATED WITH SIMILAR TYPES OF STEM-END DISCOLORATION.

Aucklander Tall Top potato tubers. From tuber on left both *Penicillium* sp. and *Verticillopsis* sp. were isolated, while from tuber on right *V. albo-atrum* was obtained.

Control Measures.

The control measure usually recommended is that of rogueing infected plants. Since the disease spreads, during the growing-season, from one plant to the next through the soil, it was suggested by Jardine (1922) that not only should the wilted plant be removed, but also the plant on either side. The work of McKay (1926) showed that this triple-plant method of rogueing was much more satisfactory in eliminating the disease than was the single-plant method.

Verticillium-wilt, besides being tuber-borne, may persist in the soil and cause infection of plants grown from healthy seed. It is obviously useless, therefore, to rid a line of potatoes of verticillium-wilt unless they can be grown in clean soil. McKay (1926) has shown that the fungus may live in old potato-tops from one season to the next, but

that it will not survive two seasons. He found, however, in field-crop-rotation trials that at least three years were necessary to eliminate completely the disease from the soil.

The system of potato-seed-certification in operation in New Zealand has reduced the amount of verticillium-wilt occurring in commercial crops, and there has been a marked improvement in the three most susceptible varieties—Aucklander Tall Top, Aucklander Short Top, and Up-to-Date.

Where an otherwise healthy line of potatoes is infected with verticillium-wilt the grower should plant his seed-block* on clean land (that is, land which has not grown potatoes or tomatoes for three or four years). In this block infected plants should be rogued by the triple-plant method. A crop-rotation of at least three years should be practised with the main block.

SUMMARY.

(1) Counts of wilted plants in the field is the most reliable method for determining the amount of verticillium-wilt in a crop, but does not give an absolute figure for the percentage of tuber infection.

(2) Stem-end vascular discoloration should not be used to determine the percentage of the disease in a line of potatoes, since there is little correlation between stem-end discoloration and the presence of verticillium-wilt.

(3) Suggested control-measures are three or four year crop rotation and the rogueing of infected plants, together with those plants on either side.

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* By seed-block is meant an area of potatoes where rogueing and selection may be carried out for improving the line The block should be large enough to meet the grower's seed-requirements for the following year.

The Orchard Instructor, Dunedin, reports that the youngberry has been fruited in Roxburgh. In growth this berry somewhat resembles the thimbleberry, but the fruit is larger and it is not such a rampant grower. The fruit, which was ripe during the first week in January, is black, about 1½ in. long, and not so even in outline as the thimbleberry, being more swollen in the centre while retaining a cylindrical shape. The flavour is good, and it promises to be a good cropper, but its resemblance to a very vigorous blackberry is too great to give it an unqualified recommendation.

"CROSS 7" WHEAT.

A NEW COMBINATION OF HIGH YIELD AND BAKING-QUALITY.

WHEAT RESEARCH INSTITUTE, Christchurch.

(This report contains sections of interest to farmers taken from a more complete report written by Dr. O. H. Frankel, Plant Geneticist to the Wheat Research Institute, and published as Bulletin No. 48 of the Department of Scientific and Industrial Research. The bulletin contains details of distensometer and fermentation tests, and analyses of the factors determining yield in both the cross and its parents.)

THE predominant wheat grown in New Zealand in recent years has been Tuscan, a wheat probably of Mediterranean origin, which possesses characteristics that render it very suitable over a wide range of soils and climates in the Dominion. Varieties such as Hunters and Pearl have also been grown to a lesser extent, and these three names represent the main groupings of New Zealand wheat in commercial circles to-day.

While Tuscan is one of the best-yielding wheats under New Zealand conditions, its baking-quality is not equal to that of the spring wheats of Canada, nor to that of the wheats from the drier parts of Australia. There has been, therefore, a more or less regular annual import of about 500,000 bushels of Canadian and Australian wheats (flour being counted as wheat) for the purpose of blending these with New Zealand wheats in order to improve the baking-quality of the resultant flour. Hence there has always been a desire to breed a variety of wheat which would yield well under New Zealand conditions, and which would yet be of sufficiently improved quality to obviate the necessity of importing foreign wheats. The impetus in this direction gained force from the success which had attended efforts in the same direction overseas, especially in the production of Yeoman by Sir R. H. Biffen at Cambridge.

The problem of breeding a wheat suitable for our New Zealand conditions constitutes a difficult task. In the first place, the high average yield of New Zealand wheat is due very largely to the high average yield of the predominating variety Tuscan. It must always be borne carefully in mind that yield per acre, in general, constitutes the all-important characteristic from the wheatgrowers' point of view. It is this quality of Tuscan which has placed it in higher favour with New Zealand farmers than the lower-yielding but higher-quality Pearl and Hunters varieties. Tuscan, moreover, has fully demonstrated that it is better able than any other wheat to withstand the wind losses which constitute the most serious menace in the chief wheatgrowing districts of the Dominion. Again, it is one of the most tolerant wheats as regards soil, time of sowing, and resistance to frost, dry conditions, and diseases. A combination of all these and other factors has rendered Tuscan a most popular variety from the growers' point of view, although it did not completely satisfy either the miller or the baker through

its lack of other qualities. Whoever would attempt to produce a variety which would be an improvement on Tuscan was faced, therefore, with the difficulties of producing a wheat—

(1) Which would give a yield per acre either equal to or greater than Tuscan:
(2) That would not only withstand wind damage, but all the other vicissitudes of a crop growing in a wide range of soils and climate:
(3) Which would possess a flour-yield and a baking-quality approaching that of the best varieties grown in Canada and Australia.

With these objects in view, a number of crosses between high-yielding New Zealand wheats and high-quality foreign wheats was made at Canterbury Agricultural College in 1923. From 1925 till 1929 (F_2 to F_6) single plants were selected amongst those hybrid families which on eye-judgment were selected for yielding-capacity and grain-quality. When in 1929 the Wheat Research Institute was formed, 165 lines selected from this hybrid material were handed over by the College to the Plant-breeding Station of the Institute, which was established at the College. A rod-row yield trial in 1929-30, consisting of single row plots, every fourth plot a standard plot (Solid-straw Tuscan), with ten replications, reduced the number of lines to fifteen, all of which belonged to Cross 7 (White Fife × Solid-straw Tuscan). For the last four seasons a steadily decreasing number of these lines were tested in field trials at the Plant-breeding Station of the Institute, and at an ever-growing number of localities distributed over the wheatgrowing districts. During the last season (1933-34) only one line, 7·03 (now called "Cross 7") was retained. The method applied in these field trials was either Hudson's modification of Beaven's half-drill-strip method, or, in many trials of the last season, Beaven's original method, all with ten replications.

The trials at Lincoln were conducted by the Wheat Research Institute in co-operation with Lincoln College. All other district trials were arranged by the Fields Division of the Department of Agriculture in collaboration with the Institute. These trials were conducted on a co-operative basis with the farmers on whose land they were situated.

The tests for milling and baking quality were carried out at the Chemical Laboratory of the Wheat Research Institute.

During the period of testing, a supply of pure seed was built up as the result of co-operation between the Wheat Research Institute and the Pure Seed Station of the New Zealand Department of Agriculture.

Description of Cross 7.

In the early stages of growth, Cross 7 closely resembles Solid-straw Tuscan, its growth type being strongly erect and its rate of tiller-production low. From the start of growth in the early spring, Tuscan leads in height, this difference being maintained through all growth stages. Heading takes place from two to four days ahead of Tuscan. Between heading and ripening, the leaves and stems of Cross 7 are more erect than those of Tuscan. This has the effect of making a crop of Cross 7 appear thin, although counts of heads prove the contrary. For this reason eye-judgment

of Tuscan and Cross 7 in comparative trials nearly always favours Tuscan, even in those trials where Cross 7 scores a heavy surplus yield over Tuscan. From heading until the disappearance of green

FIG. I.

Typical heads and grains of Tuscan (*a*), Cross 7 (*b*), and White Fife (*c*).

colour from the ear, Cross 7 can be easily distinguished from Tuscan by the lighter colour of its heads, a characteristic derived from the Canadian parent. In Tuscan the colour of the heads is throughout

similar to that of the leaves, whereas the Cross 7 ears are markedly paler. Cross 7 matures from two to six days ahead of Tuscan.

The mature plant of Cross 7 is similar to that of Tuscan. Its height is characteristically shorter—from 2 in. to 6 in.; the head is slightly shorter and denser, the glumes smaller, the awn-tips shorter and thinner, the grain white, slightly smaller, but of a similar elongated shape, and somewhat finer in appearance. The straw, like that of Tuscan, is semi-solid.

According to the experience of five years' cultivation, Cross 7 equals Tuscan in its resistance to shedding of grain by wind, although apparently its threshing is easier. Many reports on experiments in 1933–34 recorded severe winds on dead-ripe crops without a single case of losses heavier than those of Tuscan.

Cross 7 is distinctly more resistant to lodging than Tuscan. The season 1933–34 with its heavy rainfall in South Canterbury taxed the standing-capacity of any variety to the utmost. In a very tall and heavy crop at Morven, Cross 7 showed no inclination to lodging, Tuscan was badly laid, while Hunters and Dreadnought showed marked signs of lodging. Similar observations were made wherever there was a danger of flattening crops. There is no case on record of bad lodging in Cross 7, even when Tuscan alongside was flattened out.

Observations on the occurrence of "straw-break," an affliction of Tuscan which is causing heavy losses in some localities, showed that Cross 7 is less affected than Tuscan. In a trial in 1933–34, situated on the Springfield Estate, Methven, the Tuscan plots were affected as badly as most crops in the district, whereas Cross 7 showed only few broken straws. The yield difference of 4·8 bushels in favour of Cross 7 in that trial is, more likely than not, largely due to this factor. Whenever there was "straw-break" in experimental areas, in North Canterbury as well as in Mid-Canterbury, a similar resistance was observed.

Whereas in the occurrence of rusts no difference was noticed between Tuscan and the new variety, the latter seems to be more susceptible to loose smut. If this is confirmed, a more frequent use of hot-water-treated smut-free seed will be necessary than has been the case with Tuscan.

YIELD PERFORMANCE OF CROSS 7.

Results from thirty-six yield trials contained in the table which follows record tests of five seasons. During the last two years Cross 7 has been tried out under very different conditions of soil, climate, and management. It has been the aim to choose localities as representative as possible of their districts.

Since Cross 7 is designed to serve as a higher-quality wheat to be grown in the Tuscan area, the districts in which this variety predominates have been particularly chosen for experiments. In some districts considerations of staff and expenditure have necessitated a smaller number of trials than had appeared desirable. On the whole, the experiments of the last two seasons are well representative of a large proportion of the wheatgrowing area, and the results of the three previous years add additional weight.

If this attempt at fair representation and the large number of individual trials render permissible a combination of the results, the following summary is obtained. Only thirty-four trials are summarized, two being omitted—viz., (1) Tuamarina, where Cross 7

outyielded Tuscan by 15 bushels per acre, a result probably due to frosting of the Tuscan, and (2) Pukeuri B, which was on the same field as Pukeuri A.

Higher yields of Tuscan in twenty-two trials; of these eight are statistically significant.

Higher yields of Cross 7 in eleven trials; of these six are statistically significant.

Equal yields in one trial.

Taking these thirty-four trials, but omitting the rod-row trials of 1930–31—where the yields could not be expressed in bushels per acre—we have, as the mean of thirty-three trials,—

Mean yield of Cross 7 = 37·00 bushels per acre.
Mean yield of Tuscan = 37·84 bushels per acre.
Difference, Tuscan to Cross 7 = 0·84 bushels per acre.

Performance of Cross 7 in Comparative Trials with Solid-straw Tuscan, 1929–30 to 1933–34.

Yield Differences with Statistical Significance in Heavy Type.

Season.	Locality.	Yield, Bushels per Acre. (1929-30: Grammes per Plot.)		Flour Extraction: Per Cent Flour.		Baking Score: 40 = Very Good.	
		Cross 7.	Difference from Tuscan.	Cross 7.	Tuscan.	Cross 7	Tuscan.
1929–30	Lincoln	360 (1)	−14 (1)	..	..	..	..
1930–31	Lincoln	51·1	− 4·4	74·9	69·1	32·0	24·5
1931–32	Darfield	22·7(2)	+ 0·7	76·0	72·7	34·0	23·0
	Lincoln	70·7	+ 1·1	77·3	70·9	34·5	42·5
1932–33	Glasnevin ..	22·5	+ 1·8	71·6	68·6	38·5	37·5
	Rangiora	37·8	− 2·5	72·3	71·3	35·0	23·5
	Darfield	32·9	− **2·7**	71·7	70·8	38·5	28·0
	Lincoln	88·5	− 0·5	72·0	71·5	37·0	31·5
	Wakanui	57·5	− **8·9**	72·5	68·4	35·0	21·0
	Timaru	28·5	− 0·6	72·3	72·8	32·5	26·0
1933–34	Tuamarina ..	59·1(3)	+15·7(3)	71·0	68·5	17·0	11·0
	Omaka (Marlborough)	31·4(3)	− 0·9(3)	71·5	70·8	26·0	16·0
	Cheviot	49·7	− **6·3**(4)	72·2	71·0	28·0	18·0
	Culverden.. ..	23·6	+ 2·4(5)	73·0	72·2	34·0	30·0
	Glasnevin ..	10·7	− 0·5	72·4	67·6	28·0	27·0
	Amberley	21·8	− 2·4	72·4	69·6	19·0	15·0
	Rangiora	46·9	− 0·7(6)	73·4	73·2	40·0	25·0
	Fernside	21·8	− 5·8	71·8	71·2	33·0	28·0
	Springbank ..	28·8	+ 0·7	71·6	69·2	27·0	33·0
	Oxford	31·4	+ **6·5**	72·5	70·0	37·0	27·0
	Darfield	26·1	− 2·1	71·2	71·3	26·0	21·0
	Hororata	38·2	+ **3·7**	71·5	71·3	32·0	22·0
	Prebbleton ..	27·2	− **2·7**	72·9	70·5	25·0	20·0
	Lincoln	43·4	− 2·0	71·4	70·3	26·0	17·0
	Irwell	25·8	− 1·1	72·8	69·3	32·0	21·0
	Dorie	19·7	− **4·9**(7)	71·4	70·5	35·0	37·0
	Rakaia	32·7	0	71·6	69·6	31·0	28·0
	Wakanui	32·9	− **1·4**	71·3	68·4	34·0	18·0
	Methven	42·3	+ **4·8**	71·6	68·0	34·0	26·0
	Hilton	25·5	− 2·0	71·8	71·4	32·0	24·0
	St. Andrews ..	35·6	+ **1·3**	71·6	66·6	26·0	27·0
	Hadlow	52·6	− 1·6	71·7	71·6	30·0	25·0
	Morven	52·0	− **5·7**	71·8	68·5	28·0	34·0
	Pukeuri (A) ..	26·8	− 2·8	72·0	69·2	22·0	21·0
	Pukeuri (B) ..	25·1	− **2·9**	71·8	68·6	28·0	28·0
	Ngapara	62·1	+ **6·6**	71·2	68·9	30·0	28·0

(1) Rod-row trial; yield in grammes per plot. (2) Not 7·03, but the closely related line 7·02, which in other localities yielded equal with 7·03. (3) All replications of each variety threshed together, no statistical treatment possible; Tuamarina result doubtless significant. The large difference in favour of Cross 7 is probably due to Tuscan being damaged by frost. (4) Difference barely significant. (5) Stooks of both varieties damaged by stock, result therefore not fully significant. (6) Both varieties slightly frosted, Cross 7 more than Tuscan. (7) This result is not fully significant, owing to a mistake in sowing which resulted in a rate of seeding of 180 lb. per acre, against the intended rate of 120 lb., and the customary rate in the locality of 80 lb. Obviously the exceedingly high seeding on the light type of soil created conditions widely different from normal.

It follows that there is a more general tendency for lower yields in Cross 7, although the number of significant-yield differences is almost equal in both cases (six versus eight). The resulting average loss for Cross 7 is less than 1 bushel per acre, which, in view of the limited number of experiments, must be considered negligible. By making an appropriate use of the results of these and further experiments and of growers' observations, it should be possible to define those areas in which the prospects for equal, or higher, yields of Cross 7 are best. Even in the least suitable locality no farmer who choses to grow Cross 7 runs a risk of any considerable loss.

GRAIN QUALITY OF CROSS 7.

(1) *Flour Extraction.*

Flour-yields were obtained on the experimental flour-mill of the Wheat Research Institute, Christchurch. With reference to the significance of these data, Mr. H. E. West, Research Chemist, Wheat Research Institute, states:—

" Milling-yields are comparative within themselves, if the samples are of the same moisture, the same texture, and the same maturity. They have little real practical significance, as commercial yields are varied to suit moisture, output per hour, mill design, and quality of flour desired. On normal wheat, both experimental and commercial milling trials do not signify the actual flour-yields, but only the relative ease of obtaining a certain extraction."

It can be concluded that the pairs of results are comparable within themselves, although the practical significance of their differences should not be overestimated.

Of thirty-five pairs of results from comparative trials during four seasons (see table), thirty-three show higher flour-yields for Cross 7, and only two for Tuscan, the values of the latter being negligible (0·1 and 0·5 per cent. over Cross 7).

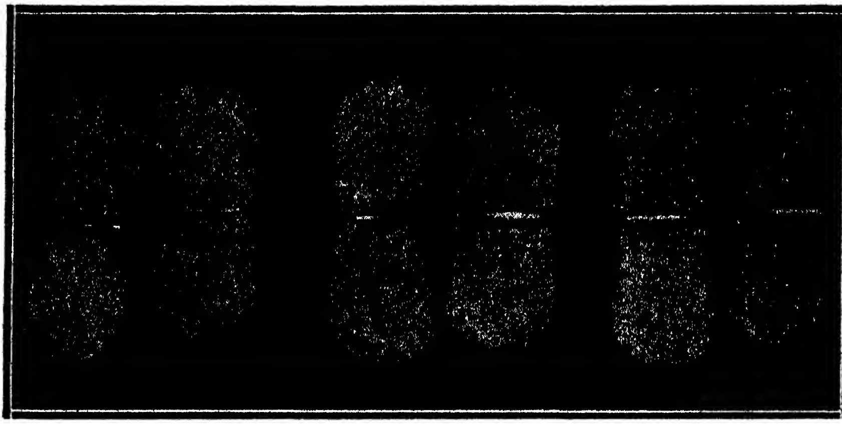
If all thirty-five trials are combined, the following mean values are obtained: Cross 7, 72·3 per cent. flour extraction; Tuscan, 70·1 per cent. flour extraction. Difference, in favour of Cross 7 = 2·2 per cent. additional flour extraction.

(2) *Baking-value.*

The baking trials followed the procedure described in the First Annual Report of the Wheat Research Institute, p. 15. Differences of about five points and over are truly significant. Out of thirty-five comparative results, only three are distinctly in favour of Tuscan (see table). One of these exceptions, Lincoln, 1931–32, is due to the remarkably high baking score for Tuscan, exceptional not only in relation to other Tuscan samples, but also in comparison with the baking scores of numerous other, commonly superior, varieties grown simultaneously on the same field. In addition to this case, there are only two significantly lower baking scores for Cross 7, viz., Springbank and Morven, 1933–34. It is noticeable that in both cases the yields of Cross 7 were significantly lower.

If all thirty-five pairs of results are combined, the following mean values are obtained: Cross 7, 30·7 points; Tuscan, 25·2 points. Difference in favour of Cross 7, + 5·5 points.

There can be very little doubt that in the majority of cases Cross 7 has given a markedly superior flour.



1 2 3 4 5 6

FIG 2

Three pairs of loaves of Cross 7 (1, 3, 5) and Tuscan (2, 4, 6) from variety trials, 1933–34, both varieties grown under identical conditions. In the pairs 1–2 (Oxford) and 5–6 (Rangiora) the differences in baking scores are large—viz., 10 and 15 points respectively in favour of Cross 7—whereas in 3–4 (Darfield) the difference is only 5 points, corresponding to the average advantage of Cross 7 over Tuscan. In all three pairs the higher quality of the Cross 7 loaf is apparent, particularly in volume, texture, and crumb colour.

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The work reported in this paper has been made possible by the co-operation of plant-breeder, cereal chemist, and field experimentalist. It has essentially been team work throughout the testing period.

The author is specially indebted to Professor F. W. Hilgendorf, Director of the Wheat Research Institute, who made the cross, and, together with Mr. J. W. Calder, conducted the breeding to the fifth generation—he supplied the F 5 material from which Cross 7 was selected, and has also given continuous encouragement during the breeding process; and to Mr. H. E. West, Research Chemist, Wheat Research Institute, who supplied all data on milling and baking characteristics and bushel weights recorded in this paper. Valuable criticism and assistance has been obtained from the members of the "Specialists" Committee of the Institute, consisting of the above-named members of the Institute and the following officers of the Department of Agriculture: Messrs. J. W. Hadfield, A. W. Hudson, and J. C. Neill. Further acknowledgment is due to Professor R. E. Alexander, Director, and Mr. R. A. Fougere, Farm-manager, Canterbury Agricultural College, for continued assistance and co-operation at Lincoln.

The author has been in the particularly happy position of being able to rely upon the co-operation of the Fields Division of the Department of Agriculture for field tests throughout the wheat-growing area. To Mr. A. W. Hudson, Crop Experimentalist, Plant Research Station, and to the staff of the Fields Division in Canterbury and Otago, specially Mr. R. McGillivray, Fields Superintendent, and Messrs. W. Stafford (Timaru), E M. Bates (Ashburton), G. Calder, and H. de O. Chamberlain (Christchurch) and Elliott (Blenheim) in the Canterbury district, Mr. R. B. Tennent, formerly Fields Superintendent, and Mr T. Sellwood (Oamaru) in the Otago district, the credit is due for organizing and conducting a dense network of variety trials of high reliability, which both in extensiveness and accuracy of results have hardly been excelled in any part of the world.

Mr. J. W. Hadfield, Agronomist, and Mr. R. Thomson, Assistant in Agronomy, have been responsible for the production of pure seed for distribution.

Special thanks are due to the numerous farmers who co-operated in conducting field trials, and to Mr. C. H. Hewlett, General Manager, Canterbury Seed Co., Ltd., for the hot-water treatment of the seed and for organizing its propagation.

SUMMARY.

(1) The parents of Cross 7 are Tuscan, a high-yielding New Zealand variety, and White Fife, a high-quality Canadian variety.

(2) The Cross has all the growth characters of Tuscan, including its resistance to the threshing action of wind. It is, moreover, about 4 in. shorter in the straw, four days earlier in ripening, markedly more resistant to lodging, and somewhat more resistant to straw-break. It is, however, probably more susceptible to loose smut.

(3) The yield of the Cross is, as the result of thirty-six trials in thirty-two localities from Blenheim to Oamaru, about three-quarters of a bushel less than that of Tuscan, and there are probably certain localities where its yield would be better than this.

(4) The percentage of flour produced is constantly 2 per cent. better in the Cross than in Tuscan.

(5) The baking-score of the Cross is almost constantly better than that of Tuscan, the average result being: Tuscan, 25·2 points; Cross 7, 30·7 points.

(6) About 3,000 bushels of seed are being distributed in 1935 in such a way as to secure the largest possible supply of pure seed for 1936.

In some circles there has perhaps been a tendency, because agriculture has been suffering from over-production to say that research should be curtailed. The present confused state of production, to my mind, constitutes a particularly strong reason why research should be expanded. In this crisis, in which we are attempting to blaze new ways out, it is folly to operate under a dim light. In the first place, the problem of the individual farmer is never as before keyed around economy of production and quality of product. If we are to regain our foreign markets and expand our domestic demand the type of research having to do with production costs and quality of product is needed as never before.—*Henry A. Wallace.*

SULPHURIC-ACID TREATMENT OF MANGEL SEED.

AN ACCOUNT OF WORK RELATIVE TO THE YIELDS OF TREATED AND OF UNTREATED SEED.

H. P. DONALD, Canterbury Agricultural College, Lincoln.

IN 1927 experiments were undertaken at Cambridge University to test the possibility of improving the germination of sugar-beet seed by treatment with strong sulphuric acid. The yield of sugar beet is closely associated with the completeness and evenness of the strike, so that the slow and uncertain germination of the seed has probably a deleterious effect on the size of the crop. The results of laboratory and field tests of treated seed against untreated which have been published by Hanley and Woodman and Garner and Sanders show quite clearly that over a period of three seasons treated seed of sugar beet germinated more quickly, gave a fuller "plant," and resulted in a greater yield of roots than untreated seed.

The close resemblance of mangel and sugar-beet seed caused Mr. H. J. Geddes, formerly of Canterbury Agricultural College, Lincoln, to try the treatment with mangel seed, which, particularly in areas liable to dry spring seasons, germinates very irregularly Laboratory germination tests indicated that, like sugar beet, mangel seed germinated much more quickly after acid treatment. Garner and Sanders have also been working with mangels, but so far have not found an increased yield (although the plant population was greater) after the sowing of treated seed.

In the spring of 1933 further investigation of the effect of treatment on germination and yield was undertaken at Lincoln, and the results which follow were obtained.

The two main advantages of faster germination would be:—(1) Establishment of seedlings in soils too dry to suit ordinary seed; and (2) more successful competition with weeds. Good cultivation does much to secure reserves of moisture in the soil and reduce the amount of weed-growth, but improved germination undoubtedly is of considerable complementary value. Counts of plants have, therefore, been made in the field at short intervals after seedlings began to appear, and an attempt was made to estimate the effect of number of plants per chain on final yield.

METHOD OF TREATMENT.

The mangel "seed" or cluster consists of as many as five or more true seeds encased in the hard corky remains of the mangel flowers. The outer casings appear to retard the penetration of moisture to the seed, so that methods of removing part of them permit faster germination. Mechanical milling has been tried with some measure of success (Garner and Sanders). Strong sulphuric acid acts rather differently. Much of the corky part of the cluster is actually burnt off, and the "seed" becomes darkened, smoother,

and smaller. In this condition it seems to wet more easily, and possibly forms a closer contact with the soil. The small caps which fit over the seed are also more readily dislodged.

With some modifications, the method used by Hanley and Woodman was followed.

The seed was placed in a large earthenware receptacle, and enough strong sulphuric acid (80 per cent.) added to wet it thoroughly. The seed was stirred periodically to mix it well with the acid, and at the end of forty-five minutes plunged into a large bucket with water running rapidly through a gauze panel in the side. After washing for fifteen minutes in this way, the seed was transferred to another bucket of water made just alkaline with ammonia. This was repeated until the washings became neutral to litmus, usually after three changes of water. After another two minutes' rinsing in fresh water the seed was drained, spread thinly on paper, and placed in a drying-room. Great care should be exercised in handling sulphuric acid, which may inflict very severe burns, and even blindness if it splashes into the eyes. Acid-resistant vessels such as earthenware basins should be used, and a good supply of water kept handy. Should acid be spilled on the skin, it is advisable to wash well with plenty of water and then bathe with dilute ammonia or lime water. Neutralizing the acid first with alkali is to be avoided.

Some of the seed was treated with 98 per cent. commercial acid in these investigations. It was found that 1,000 c.c. of this acid added to 365 c.c. of water gave the desired concentration of 80 per cent. One pound of seed requires from 250 to 300 c.c of acid, and during treatment decreases about 20 per cent. in weight if little or no seed is lost.

LABORATORY GERMINATION TESTS.

Detailed investigation of the effect of the acid on germination has not taken place. Certain tests made, however, bear out the more extensive results for sugar beet already published. The temperature of the incubator unfortunately varied up to 3 degrees C. on either side of 25 degrees C., but so many trials were made in various parts of the incubator that it is certain that the germination was hastened. Some typical results with different lots are—

Table 1

—	Number of Seeds per 100 Clusters germinated on Fifth Day.
Untreated	30
Treated	113
Untreated	3
Treated	110
Untreated	37
Treated	64
Untreated	3
Treated	70

Field Germination.

On 4th October, 1933, treated and untreated seed was sown on a ridged field at Lincoln. The land was in potatoes the previous year, and was well cultivated. Fertilizer at the rate of 3½ cwt. of mixture of superphosphate, sulphate of ammonia, and potash in the proportions 4 : 3 : 2 was broadcast before ridging, and a further 1 cwt. of superphosphate was applied with the seed. The experimental area was sown with a P. and D. Duncan mangel-sower, distributing the Long Red variety as follows: Untreated, two rows; 98 per cent. sulphuric acid, two rows; untreated, two rows; 80 per cent. sulphuric acid, two rows. This was repeated and then another two rows of Long Red untreated sown. A similar and adjacent layout was adopted for the Yellow Globe variety. The ridges were firm and fairly moist inside, but were rather dry when rain fell sixteen days later. One week after sowing seedlings of fat-hen and a few mangels appeared. Germination was still backward on 23rd October. The rain which fell just previously rendered germination more difficult by caking the ridges. Some damage, particularly to the Yellow Globes, was done by birds. The crop was hoed and singled in late November, and received several horse-hoeings after this.

On a neighbouring portion of the same field 3 acres of mangels were sown on the flat Practically the same quantities of fertilizer were applied. The soil was in good condition and quite moist just below the surface. From observation on this area, it appeared that the mangels germinated more quickly on the flat than on the ridges, and that treated seed germinated distinctly better than untreated.

Rate of Seeding.

It was found impracticable to sow equal numbers of treated and untreated seed with the machine used. The rate of seeding would clearly have a considerable influence on the apparent speed of germination, so that the following figures are important in evaluating the results of the germination counts. They show, unfortunately, that the rate of seeding was probably very different from row to row.

Table 2.—Estimated Number of Seeds sown per Chain.

Ridges.		Flat.	
Long Red (98 per cent. acid) ..	450	Long Red (98 per cent. acid)	.. 580
Long Red (80 per cent. acid) ..	290	Long Red (control) ..	.. 680
Long Red (control)	570	..	
Yellow Globe (98 per cent acid)	350	..	
Yellow Globe (80 per cent. acid)	250	..	
Yellow Globe (control) ..	430	..	

These figures draw attention to the huge excess of seeds sown. If 6 lb. of seed are sown to the acre, about 180,000 clusters are sown on 280 chains of row. This is equivalent to about 640 clusters per chain or 10 per foot. If the mangels are thinned to 1 ft. apart, ten times too many clusters and thirty times too many

seeds are sown. Mangel clusters usually have about 95 per cent. laboratory germination. The great excess of seed which it is found necessary to sow must be due either to faulty drills or to unsuitable soil conditions.

Comparison of Germinations and Yield in the Field of Different Treatments and Varieties.

Germination counts were made on four columns 1 chain wide marked off across the ridges, and spaced so as to be representative of the whole length of the ridges. Four replicates of each treatment for both varieties, together with four corresponding control (untreated) replicates, occurred in each column, so that altogether each figure on which conclusions were based was the average of sixteen paired plots each 1 chain long.

Field germinations were counted on three dates before thinning, and on a final one when the roots were weighed at harvest.

The results were entirely inconclusive. Of the twelve comparisons (two varieties, two acid strengths, three dates) made before thinning, the differences from control were non-significant in nine cases and significant in three After thinning eight comparisons (two varieties, two acid strengths, two dates) gave non-significant differences in five cases and significant in three. The weights of roots harvested showed a significant difference when Long Red treated with 98 per cent. acid was compared with control, but non-significant differences in the three other cases.

Conclusion.

Work at the Cambridge University indicating improved germination of acid-treated mangel seed has been supported by investigations at Lincoln. There is, however, as yet, insufficient evidence to conclude that yields are increased by the treatment. It should be borne in mind that, since so many seeds in excess of requirements are sown, it will be only in seasons or areas of very poor germination of untreated seed that treated seed may show any final superiority of yield Work at Lincoln seems to emphasize again the importance of good cultivation during the preparation of a seed-bed, and of proper thinning. The best thinning distance naturally varies, but on the plots examined this year the best yields were obtained with at least sixty plants per chain.

Notes.

The investigation is reported in detail in the half-yearly report of the research work done at Canterbury Agricultural College. The report includes tables showing laboratory field germinations at different dates, germinations of seeds of different sizes, the effect of thinning to different spacings, the weights of individual roots, as well as the result of a uniformity trial. A copy of the detailed report will be sent to scientific workers asking for it.

The author wishes to acknowledge the assistance he received from Mr. R. A. Fougere, Farm Manager, for willing co-operation in the field work, and from Messrs. Blair, Elliot, and Fleming, degree students, who carried out much of the harvesting and statistical work.

Mr. C. E. Iverson, M.Agr.Sc., of Napier Boys' High School, last year made a trial of the sulphuric-acid method of seed treatment on land similar to that exposed by the drainage of the Ahuriri Lagoon. He used the Yellow Globe and Long Red varieties in duplicated plots. In the Yellow Globe both treated and untreated germinated well, but in the Long Red the untreated plot germinated poorly. At harvest of the crop three weighings were made on each plot with the following results:—

Variety.	Treated Seed.	Untreated Seed.	Difference in Favour of Treatment.
	Tons per Acre.	Tons per Acre.	Tons per Acre.
Long Red	100·7	76·3	24·3
Yellow Globe	93·9	86·8	7·1

Mr. Iverson states that the increased yield of Long Red was significant, and that the high yield is indicative of what may be expected from development of the lagoon land.

HEALTH OF FARM ANIMALS.*

W. C. Barry, M.R.C.V.S., Director of the Live-stock Division, Wellington.

The subject of the health and maintenance of live-stock is of supreme importance economically. Its significance increases in proportion to the relative position occupied by agriculture and the live-stock industry in any particular country. Accordingly, in New Zealand, in which agriculture and the primary products are the mainstay of the population, the health of live-stock is a subject which vitally affects our economic interests. Health of live-stock is a question to-day of no less than international importance, as it is one intimately associated with the exportation of animal-produce from one country to another. Importing countries are each year becoming more exacting in their requirements regarding certification of freedom from disease in all meat and other animal-products allowed entry. It is questionable, however, whether the significance of this is really appreciated, and whether a full realization of the responsibility that rests on those who are entrusted with the protection of the health of live-stock exists in this country. The fact that not one carcass of mutton, beef, or pork can be exported without veterinary certification is a forcible illustration of the point raised.

The relationship of animal-health to the export of our primary products, is, however, only one aspect affecting the stockowner. Loss, wastage, and deterioration brought about by disease in stock is another, and probably the one which appeals most in that the economic loss involved is at once apparent.

The maintenance of animal-health involves the procedure associated with the practice of preventive veterinary medicine, and includes, firstly, protective quarantine measures such as are to-day recognized as affording adequate protection against the introduction of disease, and, secondly,

* Substance of an address broadcast from Station 2YA on 14th May, 1935.

deals with the cure and prevention of such diseases as are existent in the country. Prevention can again be split up into the use of animal-inoculation in certain diseases, the adoption of the principles of veterinary hygiene in the control of disease, and, lastly, and probably the most important of all, improved practice of animal-husbandry, which means a fuller recognition and application of the better care, feeding, and general management of all classes of live-stock.

Quarantine measures in the protection of animal-health become increasingly necessary as the present-day speeding-up of overseas communication progresses—even the possibility of aerial transport as a means of introducing disease cannot be ignored. The introduction of rabies in a dog surreptitiously brought into England by aeroplane from the Continent some years back is a case in point. The introduction of the virus of one or other of the animal plagues which are endemic in Asiatic countries by means of aerial transport is not beyond the realms of possibility in the future. To the ordinary individual the subject of quarantine begins and ends with the total prohibition of animals from a particular country, or their admittance subject to a period of detention in isolation on arrival. Actually, in many instances this is not the most important aspect of quarantine work, and of far greater significance is the possibility of the introduction of serious animal disease without the importation of the live animal. To understand this danger it is necessary to explain that the specific virus which causes certain diseases can be present in the animal body during the incubative period of the disease—in other words, before any symptoms of the disease manifest themselves. If such an animal were killed at this stage, the carcass would contain the virus, which is capable in many instances of living for considerable periods, and may be carried to distant countries on board ship. Meat-scrap, bones, &c., from such carcass, if put ashore as ship's garbage, may, if fed to animals, start an outbreak. Foot-and-mouth disease and swine-fever are two diseases which have been introduced into countries in this manner. An outbreak of foot-and-mouth disease which occurred in California a few years ago was traced to the feeding to pigs of garbage from a steamer which was in port at San Francisco and which had provisioned meat at one of the South American ports, in a country in which foot-and-mouth disease was present. Rinderpest, or cattle plague, which is endemic in Southern Asia, and which has caused enormous losses in Egypt and South Africa, is caused by a virus which can retain its virulence for months, and so the arrival of infected material on ships from the East is accordingly possible. Only a few years ago an outbreak of rinderpest, which fortunately was quickly suppressed, occurred in Western Australia. In this instance the infection was brought in live animals used as ship's stores on board a steamer from Asiatic ports. Anthrax can be introduced in infected bone manure, hair, skins, &c. Outbreaks of anthrax in New Zealand in former years were traced to imported bone manures, and were controlled by a regulatory system of manure-sterilization. Bone manure was also a medium of the introduction of the disease known as blackleg.

What has been said indicates the importance of rational veterinary quarantine regulations, and the constant vigilance which must be exercised in port quarantine inspection work, if animal disease at present exotic to New Zealand is to be kept out of the country. Referring to

this, Sir Arnold Theiler, the eminent South African veterinary scientist, during his visit to New Zealand last year, expressed the opinion that our greatest danger zone in this respect was formed by Asiatic countries, through the possibility of disease reaching New Zealand in some way or other by ships from Asiatic ports.

The oft-repeated maxim that prevention is better than cure can be claimed to reach its highest significance in its application to animal-disease. The cure of a sick animal is, no doubt, a most desirable object, but in the prevention of disease lies the desideratum to be aimed at both by veterinarian and stockowner. A large percentage of the diseases affecting live-stock in this country can be prevented to a considerable extent if certain prescribed essentials are carefully followed out. Unfortunately, the road leading to prevention is not always an easy one to follow, involving, as it frequently does, laborious precautions and the adoption of troublesome detail. Nevertheless, the stockowner who has sufficient interest in the matter, and is prepared to go to a certain amount of trouble, can, as a recompense for his efforts, achieve highly profitable results in the direction of disease-prevention amongst his live-stock. Numerous instances of this can be recorded : two of them follow. The disease of dairy cows known as mammitis is responsible for heavy loss to the dairy industry. Admittedly there is no curative treatment which as yet can be relied upon. Preventive inoculation likewise is disappointing. Nevertheless, if certain control measures be adopted, the spread of the disease through a herd can be prevented. These measures involve a monthly bacteriological examination of the milk of each cow in the herd—this is done for the farmer, free of charge, by the Department of Agriculture. Grouping of the cows into (*a*) healthy, and (*b*) those capable of spreading the infection, with separate milking of the groups, coupled with rigid application of prescribed hygienic precautions in the milking-shed, has been productive of very gratifying results. This control has received its widest adoption in the Waikato district, where a number of dairy-farmers have achieved such good results over several seasons that they are prepared to go on with the method. A second example of the reward of preventive measures can be instanced in the disease of sheep in Hawke's Bay known as "black disease." A few years back this was responsible for rather heavy losses on farms in certain areas of Hawke's Bay. The disease, a bacterial one, was earlier shown in Australia to be associated with the presence of the parasite known as the liver fluke, which is found in sheep in Hawke's Bay. If the liver fluke could be prevented, 'black disease" disappeared. The elimination of the fluke involved drainage of swampy areas, the dressing of such areas with copper sulphate solution, and the medicinal dosing of sheep with the drug carbon tetrachloride. The advice given by the Department of Agriculture was adopted by a large number of sheep-farmers in the affected areas, with the result that "black disease" has practically disappeared from those farms, and has ceased to be the cause of the serious losses previously encountered.

Preventive inoculation is practised and affords protection against many of the more serious animal-diseases. In countries in which they exist, such diseases as rinderpest, anthrax, pleuro-pneumonia, and swine-fever are to a large extent limited by the application of preventive vaccination. Unfortunately, vaccination has not yielded results in some of the more common stock diseases. Vaccination against blackleg has

been carried out for years past by the Department in those districts of the North Island in which this fatal disease of calves is prevalent, preventive inoculation in this instance being eminently successful. The possibility of vaccination as a means of disease-prevention is a natural desire on the part of stockowners, in the hope that the insertion of a dose under the animal's skin by means of a syringe will end trouble and obviate more laborious preventive measures. The wish is perhaps excusable, but we are, as yet, far away from the millennium in this respect.

In the adoption of improved methods of animal husbandry lies our greatest chance of lessening the incidence of animal-disease and of raising the standard of animal-health. Animal husbandry collectively includes the general management and feeding of live-stock and the application of approved hygienic measures, where such are needed. The role which management and feeding play in the maintenance of animal-health cannot be emphasized too forcibly. Generally, the management of stock in this country very frequently follows an established rule-of-thumb system which does not encourage the individual study of stock requirements, and therefore falls short in producing the best results. It is questionable whether the average stockowner appreciates his full responsibility in this respect. In delegating the work to others he often neglects that supervisory attention which is essential if any degree of interest in the performance of work is to be expected from those who execute it. Yet the owner is the person primarily responsible, and it is apparent that if he entrusts to others—either in the capacity of share milker, or ordinary employee—the duty of looking after his animals he is failing in his responsibility if such animals are in any way neglected. This lack of detail is not intentional, rather is it the outcome of a trend of indifference which is very apparent to any one who is brought into intimate contact with the matter. The reason for this has often been asked, and generally it is accepted that the matter had its origin in the low values of stock in this country originally, conducing to the view that it was not worth while paying attention to the subject This explanation cannot be accepted to-day, when the increasing and national importance of milk- and meat-producing animals demands an enlightened view, not only of the diseases to which such animals are liable, but of all the conditions that have any bearing on the daily routine of their existence. One of the surest means of inculcating regard and interest in the welfare of animals under their charge is the education of the youth of the country in this direction, and towards this end the movement known as Boys' and Girls' Calf Clubs, and similar organizations, are assuredly on right lines. The stimulus here given to boys and girls to take an interest in their animals, introducing as it does the competitive element, is of tremendous value in cultivating that watchful care and keen sense of observation of the animal's progress which lays the foundation of the requirements of a successful stockowner. The latter is, as a rule, one who can pick out at a glance the animal which is not thriving as well as it should, and can apply his knowledge to seek the cause. In no walk of life is a keen sense of observation more necessary than to the person who has charge of live-stock. This is a faculty not possessed by all alike, and is probably to a certain extent inborn, but can, however, be very largely cultivated. Another important educative function of the Calf Clubs' activities is

the training of boys and girls in the proper manner in which to handle stock, and this is a point of the greatest importance. Nothing is so obnoxious to the real lover of animals as to see them treated in that careless and rough manner which at once stamps the person so guilty as better suited to some other occupation.

In successful stock management the provision of a plentiful food-supply during those periods of the year when seasonal influence limits the growth of ordinary pasture is a highly important factor. From the animal-health point of view, the provision of adequate winter feed for dairy cows is of enormous significance. This particular subject has been repeatedly stressed, but its importance fully justifies reiteration. From the drying-oft period to her next calving is a period of the cow's existence when Nature demands a repletion of the drain on her system, mineral and otherwise. We must endeavour to effect this by supplementary feed. Well-saved hay, good silage, adequate supply of roots, concentrates, if necessary, the use of bone-meal licks, &c., are all indicated in the successful wintering of the dairy herd. There is very little doubt that many of the troubles which affect dairy cows after calving could be minimized materially by better attention to winter feeding, coupled with better provision of shelter during the winter months. In sheep husbandry, also, the maintenance of the in-lamb ewe's condition at a satisfactory level during the winter months is known to influence largely a diminished incidence of those troubles associated with the lambing period. In this direction, the winter feeding of silage to sheep is a subject worthy the attention of sheep-farmers.

Many of the troubles which occasionally affect stock in New Zealand are seasonal in their occurrence, and are usually precipitated by abnormal pasture conditions. Although it is perhaps at times possible to anticipate such as the result of abnormal climatic conditions affecting pasture, their prevention is a difficult matter, and a lessening of the incidence of such troubles, when they do occur, is a problem which taxes the farmer's skill in stock husbandry to the utmost. An instance can be quoted in the condition known as "facial eczema" or facial dermatitis in sheep. This peculiar affection, which commences with an œdematous or swollen condition of the skin of the sheep's head, accompanied by irritation, very frequently ends in such severe scab-formation on the face and nostrils as even to cause blindness and extreme difficulty in breathing. The actual skin condition is known to be the result of what is termed photosensitization, or excessive sensitivity to the sun's rays. The sensitization is produced as the result of some systemic disturbance, dietetic in origin, and associated with rapid growth of feed of a luscious nature, such as occurs in the autumn period when the rainfall is above the average, and always following a preceding dry summer. Research in South Africa has recently shown the sensitizing agent to be a substance named Phylloerythrin, derived from the chlorophyll or green colouring-matter of plants. Facial dermatitis was extremely prevalent in many districts of the North Island during the autumn of the present year, when the conditions of pasture referred to were strongly in evidence. In this disease the primary disturbance appears to be connected with the function of the liver. Departmental inquiry into this trouble has been very extensive during the past autumn period. Amongst control

measures suggested, obviously the most important one is to change the sheep on to short feed. This might mean previously eating down a paddock by means of cattle, and then crowding the sheep thereon. It undoubtedly presents a difficult problem to the sheepowner, and is referred to here as one of the sheep troubles in which dietetic factors play such a prominent part. Another example is the disease of sheep known as ante-partum paralysis, or sleepy sickness, which affects ewes shortly before lambing. Here, however, in contradistinction to facial dermatitis, green feed does good, and the sheep-farmer who has made provision for some green feed, in the shape of green oats, barley, or young grass, will find a change on to such of distinct advantage when sleepy sickness is prevalent amongst his ewes before lambing.

FARMING IN THE AUCKLAND PROVINCE.

OBSERVATIONS ON FARM-MANAGEMENT METHODS.

P. W. SMALLFIELD, Fields Superintendent. Auckland.

FARMERS seldom write about farming: this is left to journalists and professional instructors in agriculture, who sometimes describe farming as the writers think it ought to be, rather than what it is. The real study of farming is the study of individual farms, and it may be of interest to turn and look at farms as they really are: to look at the land and pastures, crops and live-stock, and observe local methods of farm management.

The Auckland Province contains good soils and poor soils, heavy soils and light soils, swamps and plains, hills and mountains, all of which are farmed, here and there, in one way or another. I propose to take you over the province, north and south, east and west, to look at dairy-farms and sheep-farms, finished farms and partially developed farms; to see unimproved scrub-covered hills and bush-clad mountains: to see and hear all we can travelling right through the province from the sandy peninsula of the far North to the pumice plains of the central plateau.

I. NORTH AUCKLAND.

The long, narrow North Auckland Peninsula extends in a north-westerly direction from Auckland City: it is two hundred miles long and its greatest breadth is sixty miles. The land surface consists of scattered fragments of mountain-ranges composed mainly of grey-wacke and basic volcanic rocks, joined together by hills and rolling downs of claystone, sandstone, and limestone. Here and there, as plateaux on the downs country, occur basaltic lava flows on which are scattered low, steep-sided scoria cones; whilst in the far North and on the west coast are large areas of consolidated sand.

Originally most of the country was heavily forested. The mountain-ranges, the basaltic lava plateaux, and much of the sandstone and limestone formations were covered in mixed bush, with the kauri, puriri, and totara as common trees. Open scrub country occurs throughout the North, areas of which once carried heavy forests, but where prolonged soil leaching has lowered the soil fertility to a point

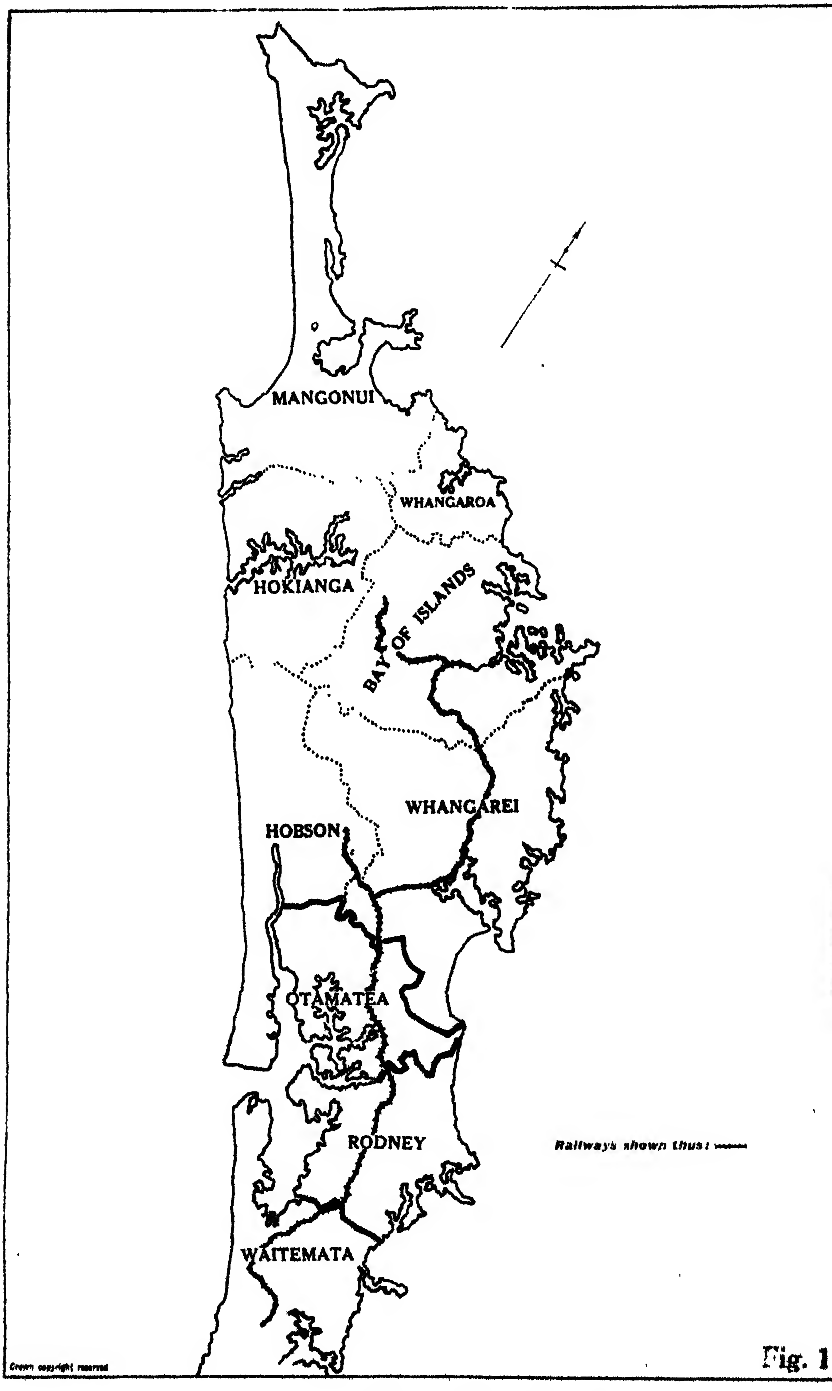

FIG. 1. COUNTIES OF NORTH AUCKLAND.

where manuka and fern have taken the place of the original forests—e.g., the "gum-land" soils, mature podsols, found on Onerahi claystones and limestones of late Cretaceous age and on Waitemata and Whangarei sandstones and claystones of Miocene age(1). There are also areas of laterite and lateritic soils(2), soils derived from basalt and which have been subject to leaching, and iron podsols on the coastal areas of consolidated sand. The forested country was first settled, whilst the open scrub country, of low natural fertility, is still largely unoccupied.

The climate of North Auckland is warm and temperate: the prevailing winds are westerly. The mean annual rainfall varies between 40 in. and 70 in. in different localities: some of the elevated areas on the west coast have a rainfall of over 100 in. per annum.

*Crops and Live-stock.—Table showing Areas in Crops and Pasture and Numbers of Live-stock in North Auckland Counties, 1933–34 **

County.	Crops.			Live-stock.			
	Annual Crops.	Pasture.	Pasture cut for Hay and Ensilage.	Dairy Cows.	Other Cattle.	Sheep shorn.	Pigs.
	Acres.	Acres.	Acres.				
Mangonui ..	416	109,531	1,456	22,046	21,782	60,822	5,686
Whangaroa .	160	27,216	369	4,313	4,342	17,948	1,287
Bay of Islands ..	1,936	155,149	2,850	23,402	30,271	91,881	6,456
Hokianga ..	509	141,806	873	18,850	27,504	95,916	4,992
Whangarei ..	2,108	298,468	7,931	57,792	54,887	134,804	14,429
Hobson ..	1,154	189,721	3,594	34,353	36,564	105,789	9,712
Otamatea ..	968	158,295	3,422	30,392	29,786	88,442	9,877
Rodney ..	1,547	159,198	3,998	26,240	25,342	95,265	7,260
Waitemata ..	2,013	124,943	6,941	32,244	22,128	73,006	10,730
Total ..	10,811	1,364,417	31,434	249,632	252,606	763,873	70,429

* From A. and P. Statistics. Note.—North Auckland Land District includes Eden, Great Barrier, Manukau, and Franklin Counties, which are not shown in the above table.

There are two and a half million acres in occupation in North Auckland, of which some one and a third million acres are in permanent grass. One interesting feature of North Auckland farming is the importance of paspalum pastures. Sown originally on land that was subject to winter flooding, the grass now is being utilized generally in pasture mixtures on both ploughed and surface-sown land. It occupies somewhat the position in pastures that cocksfoot does farther south, but it has a much wider range of usefulness than cocksfoot: it will grow on wet undrained swamps, and loose sands and peats; for vigorous growth it demands soils of high fertility, but on poor soils, where cocksfoot would rapidly become tufted and stunted, paspalum will persist indefinitely with a close tight sward, although the production of feed is not large.

The area devoted to annual crops in North Auckland is small, about 11,000 acres, and practically the whole of this area is grass-supplementary crops—soft turnips, swedes, and rape. Where paspalum is the dominant pasture grass little supplementary cropping is done—viz., Mangonui and Hokianga Counties—but where paspalum is not so

dominant, particularly on the basic volcanic soil areas of Bay of Islands and Whangarei Counties, areas of roots and green crops are still grown for the summer supplementary feeding of dairy cows.

Dairying, pastoral farming, and fruitgrowing are the chief farming industries. There are a quarter of a million cows milked on dairy-farms situated chiefly on basic volcanic soils and flat alluvial land in the river valleys. Although there are numerous intensively managed dairy-farms, with a high production of butterfat per acre, the general dairy-farm management is extensive rather than intensive, and on many farms the production of butterfat per acre is very low: there is still the "bush" dairy-farm, where cow-bells are heard and stock are wintered in the bush. Pastoral farming consists in grazing Romney sheep and beef cattle, principally Shorthorns and Herefords, on the surface-sown hill country, and raising fat lambs on the basic volcanic land and easy rolling limestone country. The marketable products are wool, lamb, mutton, beef, and store stock. North Auckland is practically self-supporting in cattle and sheep; a small surplus of breeding-ewes is sometimes sent to southern districts, but generally lack the size and breeding of East Coast ewes; part of the supply of store cattle for fattening in Franklin and Northern Waikato Counties comes from North Auckland. Fruitgrowing is becoming quite an important industry: there are 4,000 acres in developed orchards, of which 2,600 acres are situated in Waitemata County.

WAITEMATA COUNTY.

June 11th, 1934: Glen Eden to Helensville.—Low undulating hills of gum-land clay surround the upper reaches of the Waitemata Harbour. To the north-west lie the Waitakere Ranges, of volcanic origin, and still partially forest-clad. These ranges, usually forming a striking feature of the landscape—looking dark and distant through the haze of a summer's day—are now hidden by misty rain which has been falling steadily since early morning. From Glen Eden to Kumeu are small farms—dairy-farms, orchards, and vineyards. Dark green lines of *Pinus radiata* trees mark the sites of orchards and gardens, which are interspersed with pasture land and grey and yellow areas in short manuka and gorse. Pasture land varies considerably, here closely eaten bright green top-dressed fields of rye-grass, paspalum, and white clover, there dry rank paspalum and tufty dry danthonia.

Just past Henderson I stopped to discuss with a farmer the treatment of an autumn-sown permanent pasture. The land had been cleared of stunted manuka and hakea last spring, ploughed and sown in grass in April. The trouble with the grass was the yellowing-off of large patches, and the farmer wanted to know what manure to use to put matters right. It was the farmer's first experience of grassing gum land, and he was far more interested in what manure ought to be used as a remedy than how to obtain better establishment in future sowings. The yellowing of the grass was due to lack of nitrogen and to overgrowth caused by late sowing, poor clover establishment, and inability to graze the rank rye-grass on account of the wet weather and soft, sticky ground. Success in grassing gum land is dependent on thorough and timely cultivation to give a moist and firm seed-bed for sowing in February

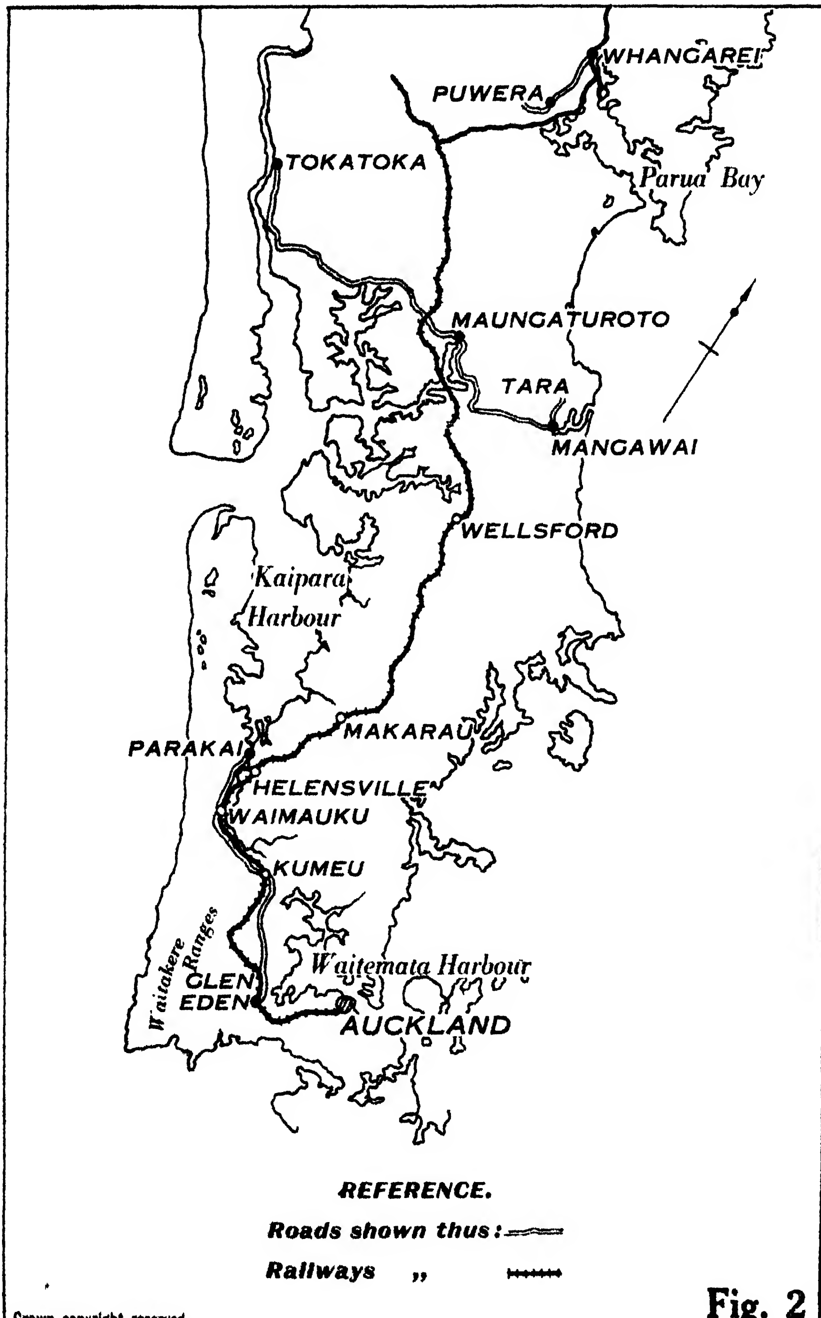

FIG. 2. JOURNEY IN WAITEMATA, RODNEY, AND OTAMATEA COUNTIES.

or early March, the use of perennial strains of rye-grass and white clover, and heavy applications of phosphatic fertilizers, and generally of lime. With early sowing on a moist and firm seed-bed clovers germinate readily and make considerable growth before cold weather occurs, and the first grazing can be made before the ground becomes soft and sticky.

The progress of development of the poor gum-land clays adjacent to Auckland during recent years has been really remarkable. Highly productive dairy-farms have been established on what was once considered an almost sterile soil. Hochstetter(3), who visited Auckland in 1858, has made some interesting notes regarding the early condition of the gum-land soils near Auckland. He writes :—

"The soil consists of a stiff whitish clay ('pipeclay'), being covered with dwarf manuka, fern, and a variety of small shrubs and tufts of grass. Nothing else seems to thrive on this sadly sterile soil, and yet that very soil bore in olden times luxuriant forest trees.

"This circumstance gives rise to various reflections: for the sterile pipeclay soil occupying such extensive tracts in the vicinity of Auckland, and especially in the districts east and west of Auckland, in which nothing will grow, not even grass, is a real calamity. The question arises: Is there no means to restore to the soil the productive power which it must necessarily have possessed of old when it produced these towering kauri forests, traces of which are plainly seen in the kauri-gum which the Natives are everywhere digging from the surface of that soil? Experienced farmers must decide this question by direct experiments. At any rate, however, the method usually pursued by the colonists upon fern heaths seems to be throughout a perverse one. If, immediately after the burning-down of the woods, grass and clover seed had been sown in its ashes and humus, a heavy growth of grass might perhaps have preserved the humus of the surface soil. But they burn again and again; the winds carry off the ashes; the rain is gradually washing the humus away, and at last nothing remains but the naked clay soil upon which *Leptospermum* (manuka) and *Pteris* (bracken fern) are scantily thriving. And in consequence of the usual burning system, even these plants are not allowed to grow strong and hardy and gradually reproduce humus; but year after year these bushes are set on fire and burnt down. The owners of the ground assert that this is done because cattle are fond of browsing the tender shoots that spring up after the conflagration. But these are growing more and more scarce from year to year, and a system, perhaps correctly applied to a fertile soil, for the purpose of exterminating the luxuriant growth of fern and preparing it for a crop of corn is certain to crush upon this stiff dry soil the last scanty trace of verdure The method of burning out was originally a custom of the Natives, who by burning cleared the forest, tilling it once after burning, and then went again in search of new ground. Thus applied the system is a correct one, but repeated burning is an abuse. After the first burning luxuriant undergrowth is produced; after the second both flax and fern, finally dwarf fern and manuka, and last of all naked soil remains."

The gum-land soils occur in patches right through North Auckland: the areas consist of undulating treeless downs rising occasionally into low hills. The surface soil consists of grey silts and clays, podsols—*i.e.*, acid soils of low fertility formed under conditions of intense leaching. The grey silts, from which most of the kauri-gum was dug, show the effects of mature podsolization. Drainage is bad, and rushes form the chief part of the natural covering along with manuka; the clays are drier and are covered in bracken fern and manuka. The gum-land soils were long neglected for farming: large areas were set aside as kauri-gum reserves, and it was only when gum-supplies became exhausted and gum prices were falling that any attention was paid to the farming possibilities of these areas. Also, as long as more fertile land was available no one bothered about these sterile soils. Early experimenters apparently never anticipated that these areas could

be made to grow good rye-grass - paspalum - white-clover pastures after being once broken up. Early development experiments aimed at first raising the soil fertility by ploughing in green crops, the use of burnt lime, subsoiling, and tile drainage—a very expensive programme. The next stage was the use of *Lotus hispidus* in pasture mixtures—a legume which thrives on a soil below the level of fertility required by white clover. Then came certified rye-grass and white clover, careful cultivation, the use of phosphates and ground limestone; and recent work has shown that these areas can be grassed at a cost of from £6 to £8 per acre.

Last autumn I saw some very successful grassing of gum land in Bay of Islands County. The virgin land was a poor grey silt, badly dug over, with large holes filled with stagnant water and timber. Taken in the rough it looked a tough proposition. In breaking in the land the settler first carried out some preliminary levelling and hole-filling. He then ploughed with a shortbreasted single-furrow plough, harrowed, and then ploughed again. The first ploughing was done in the autumn and winter and the second in the spring. The surface soil was harrowed and worked over the summer and made ready for sowing grass in February. Thorough and early cultivation with two ploughings gave an excellent seed-bed: the bottom was moist and firm—firm with natural consolidation. The surface was covered with small clods which would break down with the autumn rains and prevent the surface caking. When inspected last March grass-seed sown in February was coming up and the strike of grass and clover was excellent. Pastures twelve months old were good swards of perennial rye-grass and white clover. On this farm good cultivation, good seed, lime, and superphosphate spelled success: slightly less thorough work might have led to partial or complete failure. Without a firm bottom to the seed-bed white clover establishment would not have been good, and without white clover the rye-grass would not have flourished.

The usual grass mixture for gum land consists of 25 lb. of certified perennial rye-grass, from 5 lb. to 8 lb. of paspalum, 3 lb of crested dogstail, 2 lb. of red clover, 2 lb. of white clover, and 1 lb. of *Lotus major*—from 38 lb. to 41 lb. per acre. Cocksfoot and timothy are sometimes used in place of part of rye-grass or paspalum seeding, but their use is hardly warranted. Before sowing, most gum land should receive from 10 cwt. to 1 ton of ground limestone, and the seed should be sown with 3 cwt. of superphosphate or basic slag and again top-dressed with from 3 cwt. to 4 cwt. of phosphates four to five months after sowing. There are still large areas of undeveloped gum land, and the two chief causes that have retarded development have been lack of water and the occurrence of kauri resin in the surface soil. The lack of water still limits settlement on these areas, and the digging for kauri-gum has left the surface in a very rough condition for cultivation: the ground was roughly dug up wherever it was suspected that gum existed, and the thin layer of top soil, generally only a couple of inches thick, was buried a foot or more down, and deep holes were dug and left unfilled.

From Taupaki to Helensville the road and railway follow the valley of the Kaipara River. Orchards with their *Pinus radiata* shelter-belts

are common round Taupaki and Kumeu. Eleagnus climbing up pine-trees is used a good deal about here for shelter, and the combination of eleagnus and pine makes a splendid breakwind. Narrow belts of pine soon open up at the bottom and let a strong draught through underneath: the eleagnus fills in the bottom and prevents this. In other districts one sometimes sees poplar and eleagnus shelter-belts, and poplars certainly lend a more pleasing aspect to the countryside than do sombre pines. Trees make a wonderful difference to the countryside, and it is a pity more are not planted. It is the cost of protection fences that really deters farmers from more extensive planting. Much of the charm of the farms on the basic volcanic soil areas of the North is due to the beautiful groves of puriri trees—trees with a sturdy oak-like shape, handsome foliage, and delicately coloured flowers and fruit.

North of Kumeu and Waimauku the country changes—originally forested sandstone hills taking the place of scrub-covered gum land. Large and generally well-grassed farms occur, with Romney sheep on the hills and dairy cows on the flats. Friesian and Shorthorn herds appear as frequently as Jersey herds, and throughout the North Shorthorn herds are fairly common. There are not so many pine-trees about here, and macrocarpa trees and patches of totara and cabbage trees improve the look of the country. Pastures, although closely grazed, look well, but there is no sign yet of hay being fed out. North Auckland farmers do not start winter supplementary feeding as early as the farmers farther south. There is, however, a good deal to be said for early feeding, for, if hay and silage are fed out whilst the grass is still growing, then some fields can be closed to grazing, and the grass growth on these fields saved for early-calving cows in July and early August, and grass at this period is extremely valuable for bringing cows quickly to their maximum production.

At Wharepapa the valley opens out into the tidal stretches of the Kaipara River. To the west of the valley are sand-hills which extend northwards and form the South Head of the Kaipara Harbour. To the west of Helensville lie the Parakai Flats, rich heavy alluvial land in rye-grass pastures—good dairying and fattening country. Many of the best pastures have been tile drained: this work was done a good many years ago and was well worth the expense. Tile drainage has made the land much earlier, and has improved the conditions for winter stocking. I was first here about twelve years ago when some of this tile-draining work was going on. On one farm the fields before draining were covered with quite fair pastures of rye-grass and white clover, but there were wet patches all over the fields that got very boggy in the winter and where pennyroyal grew luxuriantly. Each winter the area of these boggy patches was extended with the trampling of stock. The land had originally been ploughed-in "lands" slightly less than a chain wide, and the tile drains were run up each "finish." This is general practice, for the drain is then placed in the position towards which natural seepage has led the water over a period of years. After laying the tile drains it was this settler's practice to plough, summer-fallow, and resow to grass early in the autumn. In this way he got a new vigorous pasture over the whole field and the full benefit of the drainage. The summer fallow was an important part of the grassing: the seed-bed was moist and firm underneath, and with early sowing the first grazing

took place before the soft recently worked clay soil became really wet with the early winter rains. One sees little tile drainage done nowadays. The cost of the work is the chief deterrent, and paspalum and *Lotus major* are used to grass the wetter areas of heavy flat land where rye-grass and white clover will not flourish.

June 11th, 1934: Helensville to Makarau.—The country is mainly surface-sown sandstone country devoted to sheep and cattle grazing, with the flats and undulating hills devoted to dairying. There is a good deal of reversion to manuka and bracken fern on the hill country. Last autumn's secondary sowings on manuka burns are showing up well on the hillsides. Last season's rise in wool prices has accounted for the renewed attention paid to cleaning up and resowing hill country.

(To be continued.)

APHIDES AFFECTING CULTIVATED PLANTS.

(3) APHIDES OF THE ROSE, CHRYSANTHEMUM, AND ELAEAGNUS.

W. COTTIER, Entomology Section, Plant Research Station, Palmerston North.

OF the aphides infesting the rose in New Zealand there are four common species—viz., *Macrosiphum rosae* Linn., *M. gei* Koch, *Capitophorus rosarum* Kalt., and *C. tetrarhodus* Walk. Those commonly infesting the chrysanthemum are *Macrosiphoniella sanborni* Gill. and *Anuraphis helichrysti* Kalt., while that on *Elaeagnus* is *Capitophorus braggii* Gill.

Throughout the summer there are commonly encountered two forms of each aphid species—viz., the wingless and winged individuals, both being female. These forms reproduce by giving birth to living young and are styled "viviparous" because of this characteristic. In the following accounts these two forms have been described for each species as an aid in identification.

Aphides of the Rose.

The rose plant seems to be particularly susceptible to the attacks of aphides, the young and succulent growth of the shoots in the spring affording excellent feeding-grounds for the pests.

CAPITOPHORUS ROSARUM Kalt.

(*a*) *Wingless Viviparous Female.*—This insect is approximately 2 mm. long, is green in colour, and presents an oval, flattened, elongated appearance. The antennæ, or "feelers," are very short, being only approximately one-third of the length of the body.

(*b*) *Winged Viviparous Female.*—This form is usually somewhat smaller than the wingless female, being approximately 1·5 mm. long. It presents a very dark appearance. The abdomen, however, is green, but is covered by a large dark patch. The antennæ, or "feelers," are very dark and are approximately three-quarters the length of the body.

HOSTS IN NEW ZEALAND.

This aphid has been found only on roses.

OBSERVATIONS.

The species appears on the rose very early in the season; after this period it appears to be scarce. It has not been observed to do any considerable amount of damage in this country.

CAPITOPHORUS TETRARHODUS Walk.

(*a*) *Wingless Viviparous Female*.—This insect is approximately 2 mm. long and is green. It is more robust, however, than the corresponding

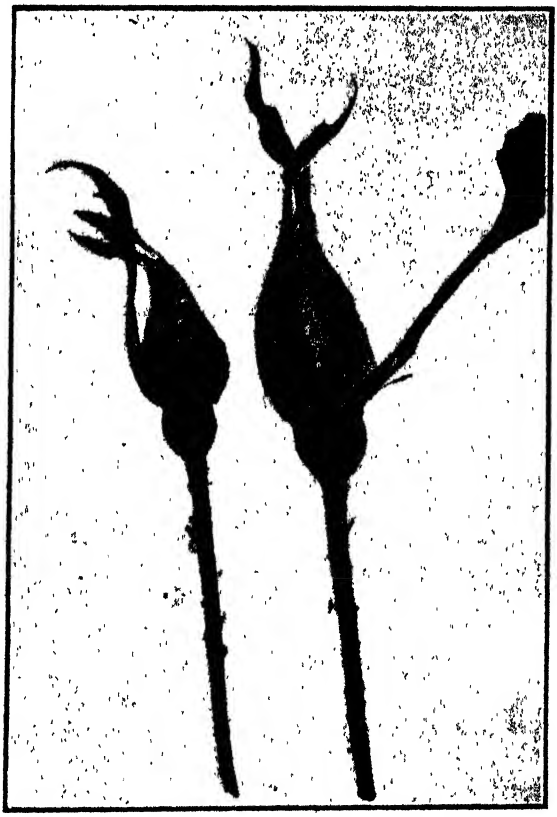

FIG. 1. ROSE-BUDS INFESTED BY GREEN APHIS (MACROSIPHUM GEI).

stage of the previous species and does not present the flattened and elongated appearance. The antennæ are somewhat more than half the length of the body, which is covered with numerous knobbed hairs.

(*b*) *Winged Viviparous Female*.—This form is approximately 1·5 mm. long and is very dark in colour. The antennæ are dark and are approximately as long as the body.

HOSTS IN NEW ZEALAND.

This aphid has been found only on roses.

OBSERVATIONS.

This species also appears on roses very early in the spring. Otherwise it appears to be rare and has not been observed to cause great damage.

The wingless viviparous female of this species can be readily distinguished from that of *C. rosarum* by the presence of the numerous knobbed hairs on the former.

MACROSIPHUM ROSAE Linn.

(*a*) *Wingless Viviparous Female.*—The length of this form is approximately 2·5 mm. to 3 mm. The insect is either green or reddish. The antennæ are as long as or longer than the body. The cornicles, or "honey-tubes," at the posterior end of the body are usually black. (For explanation of terms see the preceding article (No. 2) of this series.)

(*b*) *Winged Viviparous Female.*—Length approximately 2·5 mm. to 3 mm.; head and thorax black and the abdomen green with a few black patches; the cornicles and antennæ black, the latter being approximately as long as or a little longer than the body.

HOSTS IN NEW ZEALAND.

Taken from roses and currants.

OBSERVATIONS.

This aphid, together with *M. gei*, is the largest of the family so far found to be present in New Zealand. It is one of the most common rose pests and can be found almost anywhere its host is grown. A characteristic feature of this species is that a colony usually contains red and green individuals. The insect can be found on the rose at almost any time of the year, particularly on the succulent growth of young shoots or flower buds. Although the writer has searched for overwintering eggs of this aphid on rose plants that had been badly infested during the summer, he has as yet been unable to discover the eggs. However, this species can be found living in the summer stages on any scanty rose foliage that may be present on such plants as "ramblers" These observations were made in Palmerston North, but it is very probable that in the colder climates winter eggs are laid.

MACROSIPHUM GEI Koch.

(*a*) *Wingless Viviparous Female.*—The average length of this form is 2·8 mm. to 4 mm., the colour being green. The antennæ are usually longer than the body. The cornicles of this species are usually green with the apices darkened.

(*b*) *Winged Viviparous Female.*—This form varies from 2·9 mm. to 3·3 mm. in length. The head and thorax are usually yellowish-green with the abdomen green. The antennæ are longer than the body, while the cornicles are green with the apices darkened.

HOST-PLANTS IN NEW ZEALAND.

Rose, potato, tomato, *Solanum* sp., *Tulipa* sp., fat hen, *Brassica* spp., *Lychnis* sp., carnations and pinks, *Hebe* sp., nightshade (*Solanum nigrum*), Californian thistle, poppy, chrysanthemum, cineraria, *Cerastium vulgatum* (chickweed), strawberry, dock (*Rumex* spp.), buttercup.

OBSERVATIONS.

This species easily can be distinguished from *M. rosae* by the characters of the cornicles. In *M. gei* these organs are cylindrical and straight, their colour usually being green with the apices darkened. On the other hand, in *M. rosae* the cornicles are black, very commonly curved gently away from each other, and are usually much more noticeably expanded at the base than are those of *M. gei*. The immature forms of *M. gei* are covered by a thin white mealy coating.

M. gei appears abundantly on the young shoots of roses in the early spring. Later it may be found on the potato and others of its hosts. Miss Patch (Bull. 242, Maine Agric. Expt. Sta., 1915) states that in America it passes the winter in the egg-stage on woody plants, the rose being the favourite. Although in New Zealand this aphis does generally appear first on the rose, which fact suggests overwintering eggs, endeavours to find such eggs have so far failed. Another favourite host-plant is the sow-thistle (*Sonchus oleraceus*) and the writer has found the young succulent parts of these plants overcrowded with colonies of *M. gei* in the late autumn. The insect is still on the thistle at the middle and end of the winter, although in much reduced numbers. It has also been found sparsely on "rambler" roses in midwinter. There can be no doubt that the insect can pass the winter in the asexual stage, provided suitable host-plants are available.

Aphides of the Chrysanthemum.

MACROSIPHONIELLA SANBORNI Gill.

(*a*) *Wingless Viviparous Female.*—This form is very dark-brown to black in colour and is very shiny, its average length being approximately 2 mm. The antennæ are approximately as long as the body and, except for a portion near the head, are black.

(*b*) *Winged Viviparous Female.*—Same in colour and size as the wingless form. Antennæ approximately as long as the body.

HOSTS IN NEW ZEALAND.

Chrysanthemum.

OBSERVATIONS.

This aphid is common on chrysanthemum and might be called the characteristic aphid of this plant. It is most frequently found clustered on the young growing shoots and often does great harm to buds. In New Zealand nothing is known of the overwintering habits of this species except that they might breed all through the winter on plants under glass.

ANURAPHIS HELICHRYSTI Kalt.

(*a*) *Wingless Viviparous Female.*—Length of this form 1 mm. to 1·5 mm.; colour green to yellow-green; antennæ yellowish-green and are approximately half the length of the body.

HOSTS IN NEW ZEALAND.

Chrysanthemum, ragwort, ox-eye daisy, plum, red clover, *Cineraria* sp., *Salpiglossis*, sunflower, *Albizzia* sp.

OBSERVATIONS.

This aphid appears to be characteristic of plants of the daisy family. The writer has found it severely damaging ragwort in March in parts of the North Island. Theobald (*Aphididae of Great Britain*, Vol. 2, 1927) states that this is one of the commonest aphides found on plum, frequently causing great damage. In New Zealand the dominant species on the plum is *Rhopalosiphum nymphaeae* Linn., and, as far as our present knowledge allows, *Anuraphis helichrysti* appears to be comparatively unimportant as a pest of this plant. *A. helichrysti* has been known also to cause severe damage in seed-clover crops, the constant sucking of the sap by these small insects preventing the development of the seed-heads.

Nothing is known of the hibernation habits of this insect in New Zealand. In England, however, Theobald (*loc. cit.*) states that eggs are laid in the autumn at the bases of the buds on plum and these do not hatch until the following spring. When hatching occurs the young aphides feed on the developing plum leaves and even blossoms. After living on the plum for two to three months the colony produces winged forms which fly to various herbaceous plants such as clover, ragwort, *Cineraria* sp., &c., and produce colonies which damage their herbaceous hosts.

The Aphid of Elaeagnus.

CAPITOPHORUS BRAGGII Gill.

(*a*) *Wingless Viviparous Female.*—Length approximately 1·5 mm. On the body the ground colour is very light-yellow suffused with purplish pink, and superimposed on this there are several green markings. The antennæ are light to dark and are approximately as long as the body. The head, sides, and posterior portion of the body are covered by conspicuous knobbed hairs.

(*b*) *Winged Viviparous Female.*—Length approximately 1·5 mm. to 2 mm. The head and thorax are dark, while the abdomen is a dirty white colour with a large dark central patch. The antennæ are dark and are slightly longer than the body.

HOSTS IN NEW ZEALAND.

This species has been found breeding only on *Elaeagnus*.

OBSERVATIONS.

This aphid is very widespread in New Zealand. It has been found both in the North and South Islands, wherever *Elaeagnus* hedges are grown. Infested plants become covered with black sooty mould growing on the honey-dew which is given off by the insects, and a very disagreeable odour can be noticed emanating from badly infested hedges.

By May the aphides have laid their black winter eggs at the bases of the buds on the woody parts of *Elaeagnus*, and these remain until the spring when they hatch to carry on the damage caused by these pests.

Control.

An understanding of the habits and hosts of aphid pests will assist greatly in control-measures. For example, with the rose aphides it is known that *Macrosiphum gei* can and does pass the winter in the normal summer form on any rose foliage that is available—*e.g.*, that of

"ramblers"—or on any of its other hosts if sufficient succulent green material is present to furnish a food-supply—*e.g.*, the sow-thistle, *Sonchus oleraceus*. Therefore it behoves those who are interested to see that infestation in the following spring does not come from other hosts, weeds or otherwise. Such hosts can either be removed or cleaned of any aphides by a suitable spray, such as one of those described below. In the summer, too, one should be on the watch to see that infestation is not coming from some other host of the particular aphid concerned.

The most useful material to use as a spray against aphides is nicotine sulphate. This should be used at the rate of 1 part to 800 parts of water in which soap has been previously dissolved at the rate of 3 lb. to 4 lb. per 100 gallons. Soapy water alone, made by dissolving soap at the rate of 3 lb. to 4 lb. per 100 gallons of water, can also be used, but it is a poor substitute for nicotine sulphate. Care should be taken not to make the soap solution too strong, as injury might result to sprayed plants. Summer-grade white oil used at the rate of 1 part to 80–100 parts of water is also an effective spray against aphides, but care must be exercised in its use since it may be liable to damage very tender foliage and flowers. It can generally, however, be applied to rose foliage A very good but somewhat expensive spray for rose plants before they are in flower is a combination one of nicotine sulphate 1–800 plus summer white oil 1 to 80–100. The oil "tones up" the foliage as well as helping to kill the aphides.

POTATO-GROWING IN NEW ZEALAND.

II.—DESCRIPTION OF VARIETIES.

R. THOMSON, Assistant in Agronomy, Government Pure-seed Station, Lincoln.

IN describing varieties it is necessary to use certain terms, which require to be understood clearly before the reader can make full use of the descriptions.

The following terms are used:—

HABIT.

A general description of the growth covering.

(*a*) *Height* when grown under average conditions. Tall, 2 ft. or over; medium, 18 in. to 2 ft.; short, below 18 in.

(*b*) *Type of growth* may be "upright," "spreading," or even "straggling."

(*c*) *Vigour* may be described as "strong," "medium," or "poor."

(*d*) *Open or compact growth.*—"Open," when the stems can be seen distinctly through the leaves; "compact," when the foliage is so dense that the stems are not easily observed.

STEM.

(*a*) *Wings.*—These are the projecting ridges which run down the stem, giving it its triangular shape. They may be either waved (crinkled) or straight, and form a useful guide to confirm an identification. Observations should be limited to the upper two or three internodes.

(*b*) *Colour.*—It is very rarely that a stem is totally devoid of colour, and the amount present, although liable to modification according to the amount of light, is a valuable aid to identification. The method used is that devised by Dr. Salaman—namely, an index of 1 to 4. Colour 1 would indicate slight coloration, more especially about ground-level. Colour 4 would represent an entirely deep red purple coloured stem, a very rare condition.

LEAF.

The potato has a compound leaf consisting of a number of leaflets. The colour may vary with the variety, being described as light, medium, or dark green, although the presence of mosaic may very materially effect this characteristic. The leaflets may be widely spaced or bunched together, giving rise to the terms, open or close, and the shape of the leaflets may vary with the variety.

INFLORESCENCE.

(*a*) *The trusses* of flowers may be prominent (carried well above the foliage) or inconspicuous (carried down among the upper leaves) depending upon the length of the flower-stalk.

(*b*) *The flowers* themselves may be numerous, scanty, or rare.

(*c*) *Flower colour* is an important varietal characteristic but one that is modified by hot weather or bright sunlight, and should be observed on a freshly opened flower. Flowers may be white or coloured, the latter being divided into red-heliotrope, blue-heliotrope, or pure blue.

TUBERS.

Although of importance as a guide to identification, the tuber, being subject to modification by environment, is not always a reliable factor in varietal determination.

(*a*) *Skin.*—This may be described as smooth, rough, russet, or scaled.

(*b*) *Colour.*—This should be observed on a freshly dug tuber, as exposure to light often brings out colour in a variety usually classed as a white. Coloured potatoes may be pink (pale red), red, light purple, or deep purple. They may be self-coloured or the colour may be unevenly distributed. Some varieties have splashes of colour round the eyes, while in others the colour may cover the rest of the tuber leaving the skin round the eye white.

(*c*) *Shape.*—This characteristic is greatly modified by soil and rainfall, and it is extremely difficult to fix a standard.

The following terms are used in these notes :—

Round : Such tubers are as long as they are broad, but may be more or less flattened. There is usually a depression at the heel end.

Long : Potatoes of this type may be either finger-shaped or cylindrical. The finger-shaped is tapering and often hooked at the heel, as in Black Kidney. The cylindrical type is of more or less equal diameter throughout its length. Kidney-shaped tubers are generally broad in the middle, tapering to both ends. They may sometimes be pear-shaped.

Oval : Describes a short kidney.

(*d*) *Flesh Colour.*—This is described as white, lemon (pale yellow), or yellow. The colour present in the skin may sometimes be present in the flesh, particularly near the eyes.

(*e*) *Eyes.*—These may be deep, medium, or shallow. They may be evenly distributed or mainly at the rose end. In some cases the eyes are coloured, and also the skin surrounding them.

(*f*) *Sprouts.*—Sprout colour is a very definite characteristic, although the intensity of the colouring is modified by the amount of light. The terms used in the following notes are pink, deep pink, purple, deep purple.

MATURITY.

Varieties are described as "first early," "second early," "early main crop," "main crop," and "late main crop."

Summary of Varieties which have been grown in New Zealand.

Variety.	Maturity.	Skin Colour.
(1) Varieties of Importance in the New Zealand Trade.		
Arran Banner	Early main crop ..	White.
Arran Chief	Late main crop ..	,,
Aucklander Short Top ..	Early main crop ..	,,
Aucklander Tall Top ..	Late main crop ..	,,
Bresee's Prolific	Early main crop ..	,,
Dakota	Late main crop ..	Red
Epicure	First early	White.
Iron Duke	Late main crop ..	,,
King Edward VII	Early main crop ..	Red and white.
Northern Star	Late main crop ..	White.
(2) Varieties of Lesser Importance in the New Zealand Trade.		
Ally	Late second early ..	White.
Arran Consul	Main crop	,,
Arran Pilot	First early	,,
American Wonder	Main crop	,,
Brownells	Main crop	Pink.
Endurance	Early main crop ..	White.
Early Regent	First early	,,
Early Rose	Second early ..	Pink.
Field Marshal	Main crop	White.
Great Scot	Early main crop ..	White.
Kerr's Pink	Late main crop ..	Pink.
Majestic	Early main crop ..	White
Maori Chief . ..	Late main crop ..	Mottled blue and white.
Sharpe's Express	First early	White
Up-to-Date	Main crop	,,
(3) Varieties of no Importance		
Arran Comrade	Second early ..	White
Arran Crest	First early	,,
Arran Victory	Main Crop . ..	Blue
British Queen	Second early ..	White.
Burbank	Main crop	,,
Duke of York	First early	Yellow.
Gold Coin	Main crop	White.
Herald	Second early ..	,,
Incomer	Late main crop ..	,,
Irish Cobbler	First early	,,
Leader	Main crop	Red.
New Era	Early main crop ..	White.
Reading Russet	Second early ..	Red.
Sefton Wonder	Early main crop ..	White.
Scotia	Main crop	Red
(4) Varieties of Little or no Importance in the New Zealand Trade, but of some Value for Garden Culture		
Abundance	Early main crop ..	White.
Beauty of Hebron	Second early ..	Pink.
Beauty of Hebron (N.Z.) ..	Early main crop ..	Mottled pink
Black Kidney	First early	Blue.
Catriona	Second early ..	White splashed purple.
Chas. Downing	Second early ..	White.
Di-Vernon	First early	White mottled purple.
Eclipse	First early	White.
Early Puritan	First early	,,
Golden Wonder	Late main crop ..	Russet brown.
Jersey Bennes	First early	White.
May Queen	First early	,,
N.Z. White Elephant ..	Late main crop ..	,,
Robin Adair	Second early ..	Red.
Witchill	First early	White.

ABUNDANCE.

Origin.—Magnum Bonum X Fox's Seedling, raised by J. Clark, and introduced by Sutton and Sons in 1886.

Foliage.—Haulm tall, upright, vigorous, compact. Stem branching, wings waved, colour 2 (bronze). Leaf dark green and glossy, arched; secondary leaflets numerous and large, giving the leaf a crowded appearance.

Flower.—White, large, and numerous, carried well above the foliage.

Tubers.—Oval to round, somewhat flat. Eyes shallow. Eyebrow distinct, long. There is generally a blue-purple coloration at the heel end and on the runners during the growing-season. Flesh clear white. Sprouts blue.

Maturity.—Early main crop.

Notes.—A variety which has been extremely popular in the past, mainly perhaps, on account of the attractive shape of the tubers combined with an average good yield. It has been a very popular exhibition variety. It is now practically out of cultivation in this country, as is evidenced by the fact that it has not in any year been entered in certification Its popularity led to numerous synonyms being put on the market It is very susceptible to late blight. No good purpose would be served by introducing it once again into general cultivation.

ALLY.

Origin.—Raised by D MacKelvie, Lamlash, in 1907. First named Arran Treasure, but on account of its inferior table quality was not put on the market. In 1915 it was reintroduced under its present name by Messrs. Poad and others.

Foliage.—Haulm medium height and vigour, spreading, dense. Stem, colour 1 only at base; wings straight Leaf dark greyish-green; leaflets large and pointed; secondaries few and small

Flower.—White and scanty, flower-stalk short, anthers malformed.

Tubers.—Round to oval, flat Eyes shallow. Skin somewhat yellow. Flesh white. Sprouts pink.

Maturity.—Late second early

Notes.—This variety was popular for a while on account of a combination of comparative earliness with an excellent shape and firm skin It is still grown to a limited extent and certified seed is available. It is not recommended for general cultivation, and could be well replaced with Aucklander Short-Top, which can be marketed just as early and gives a greater yield if left to mature. The cooking quality of Ally is very poor.

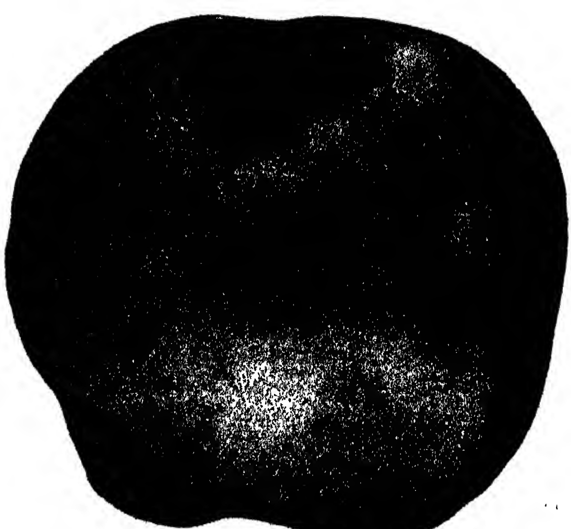

FIG. 5. ARRAN BANNER.

ARRAN BANNER.

Origin.—Raised by D. MacKelvie, Lamlash, and introduced in 1926-27. For several seasons the seed commanded a very high price

Foliage.—Haulm tall, vigorous, open, semi-erect, later becoming spreading. Stem, thick; colour, 0–1, bronzing in axils. Wing slightly crinkled Leaf open, large, greyish-green colour, soft, wrinkled, dull appearance; secondaries large

Flower.—White, rare; buds drop off; anthers malformed, flower-stalks very short.

Tubers.—Round, slightly flattened; skin white. Eyes medium to shallow, rose end deep. Eyebrow distinct. Flesh white. Sprouts pink.

Maturity.—Early main crop.

Notes.—A comparatively new variety It is a heavy cropper, producing a large proportion of table-sized tubers. It should not be grown on rich land, as the tubers grow very large and are subject to hollow heart On such land the rose end also becomes very deep. Certified seed is available, and the good shape and heavy cropping ability make it a variety well worth growing Reports indicate that the seed stocks require careful attention to keep them free from mosaic. In New Zealand it has a very wide range of adaptability, but its popularity has received a check on account of the variety being grown on land that is too heavy.

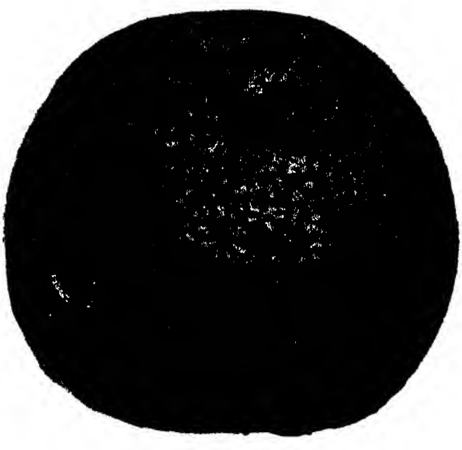

FIG. 6. ARRAN CHIEF.

ARRAN CHIEF.

Origin.—Raised by D. MacKelvie, Lamlash, in 1907, and introduced by him into commerce in 1911.

Foliage.—Haulm tall, upright, and open, vigorous. Stem, colour 1–2, mottled Wings very waved. Leaf medium to dark green, open and rigid; leaflets wrinkled, small, margin often waved.

Flower.—Inconspicuous, scanty, white with green tips, drop readily in the bud stage. Anthers pale and malformed.

Tubers.—Round and somewhat flat. Skin white and somewhat rough, often with a purple spot at heel end. Eyes medium, clustered towards upper rose end. Flesh white. Sprouts deep purple.

Maturity.—Late main crop.

Notes.—This variety is well known. It is excellently adapted for medium to heavy potato land on account of its good shape and excellent handling qualities. Unfortunately it is somewhat susceptible to late blight. Northern Star is a common rogue, but plenty of certified seed is available.

ARRAN COMRADE.

Origin.—Raised and introduced by D. MacKelvie, Lamlash, in 1918.

Foliage.—Haulm medium height, compact, and spreading ; typical drooping appearance towards maturity. Stem practically colourless. Wings straight. Leaf open, drooping, soft grey-green ; leaflets large, pointed ; secondaries well developed.

Flower.—White, fairly numerous ; flower-stalk long.

Tubers.—Flattened round, very even. Skin white. Eyes shallow. Flesh white. Sprouts purple.

Maturity.—Second early.

Notes.—Only an exhibition variety. Too subject to late blight and leaf-roll to be a commercial success.

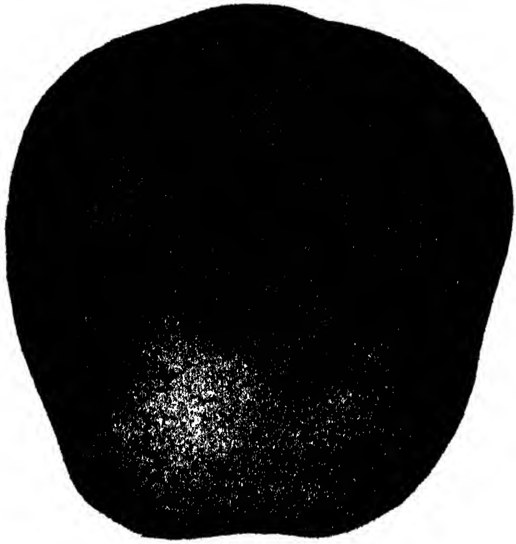

FIG. 7. ARRAN CONSUL.

ARRAN CONSUL.

Origin.—Raised by D. MacKelvie, Lamlash, and introduced into commerce in 1924.

Foliage.—Haulm tall, vigorous, upright, and open ; rather sparse. Stem, colour 0–1. Wings straight. Leaf very open, long, drooping ; leaflet medium green, narrow, pointed, hairy ; secondaries well developed.

Flower.—White, rare ; buds drop readily ; dark-coloured.

Tubers.—Short oval (oblong). Eyes shallow, rose end medium deep. Skin white and slightly coarse. Flesh white. Sprouts pink.

Maturity.—Main crop

Notes.—This variety deserves to be grown more than is the case at present. It is a good cropper and the shape is good. Its keeping qualities are outstanding, being equal to if not better than Dakota. As it is very slow to sprout, the tubers keep in the pits till late in the season with very little loss. It is distinguished by the very slow early growth, and the very open, almost spindly, foliage. Certified seed is available.

ARRAN CREST.

Origin.—Raised by D. MacKelvie, Lamlash, and introduced in 1928–29.

Foliage.—Haulm dwarf and open, spreading, and moderately vigorous. Stem, colour 1, bronzing at base. Wings straight. Leaf open, long, and drooping ; leaflets dark green, long, and narrow ; secondaries well developed, pointed ; not numerous.

Flower.—White, very rare, buds drop readily; flower-stalks very short.

Tubers.—Round. Eyes medium to deep. Eyebrow distinct. Skin white. Flesh white. Sprouts pink.

Maturity.—First early.

Notes.—Received prominence in Great Britain on account of its earliness and immunity to wart disease. Local trials have indicated that it cannot compete with Epicure, and that it is very susceptible to virus. No certified seed is available, and the variety is not recommended.

ARRAN PILOT.

Origin.—Raised by D. MacKelvie, Lamlash, and introduced in 1930–31.

Foliage.—Haulm medium height, spreading, later straggling. Stem, colour 1–2; fairly numerous. Wing broad. Leaf open, rigid, dark-green midrib tinged purple at base; leaflets broad.

Flower.—Blue-purple tipped white, infrequent; flower-stalk short.

Tubers.—Kidney. Eyes shallow, mostly on point of tuber. Eyebrow indistinct. Skin white. Flesh white. Sprout purple.

Maturity.—First early.

Notes.—Has been tried only to a very limited extent in this country. It appears to crop well for a first early, and its excellent shape makes it very promising. No certified seed is available at present.

ARRAN VICTORY.

Origin.—Raised by D. MacKelvie, Lamlash, in 1912, and introduced by him in 1918.

Foliage.—Haulm tall, vigorous, upright, and open. Stem, colour 4, extending into midribs of leaves. Wing slightly crinkled. Leaf, dark green, open; leaflet large, pointed; terminal leaflet drooping.

Flower.—Creamy white, numerous; flower-stalk medium long, buds purple, hairy.

Tubers.—Round to slightly oval. Eyes medium. Eyebrow distinct. Skin purple. Flesh white. Sprouts purple; sprouts early.

Maturity.—Main crop.

Notes.—On account of its blue skin this variety is not likely to become of commercial importance in this country. It is a good cropper, of good quality, and a fair keeper. It is rather susceptible to leaf-roll and internal brown fleck. No certified seed is available.

AMERICAN WONDER.

Origin.—Not known. The variety corresponds very closely with the "Rural" group described by Stuart, in which case it is probably of American origin, and may be one of the chief late crop varieties renamed.

Foliage.—Haulm tall, vigorous, upright, and open; centre stem distinctly upright. Stem somewhat branched, colour 2; streaked. Leaf dark green, small; leaflets crinkled and leathery, medium size, rounded; secondaries intermediate.

Flower.—Purple, with colour getting paler from centre to outside; moderately numerous. Flower-stalk medium.

Tuber.—Round to oblong, much flattened. Skin white and smooth. Eyes shallow, and mainly on upper surface at rose end. Flesh white. Sprouts blue.

Maturity.—Main to late crop.

Notes.—Crops well but has been tried out to only a limited extent.

AUCKLANDER SHORT TOP.

Origin.—Selected from a crop of Sutton's Supreme by Mr. A. J. Rich and Mr. M. Laws, of Kaiapoi. Introduced into commerce by Mr. Rich in 1910, and named by Mr. Laws.

Foliage.—Haulm vigorous, open, medium height, moderately spreading but stiff. Stem, colour 2. Wings slightly waved. Leaf medium dark green; leaflets small and crinkled.

Flower.—White, scanty; flower-stalk medium height.

Tubers.—Oval to kidney. Skin creamy-white, clear, and smooth; very thin and easily bruised. Flesh white. Eyes medium to shallow. Sprouts pale pink.

Maturity.—Second early to early main crop.

Notes.—Is the most popular variety grown in New Zealand, and can be recommended over a wide range of conditions. An excellent cropper of good

shape and very fine quality, producing a very high proportion of table-sized tubers. Its one fault is its clear thin skin which bruises easily and shows the least trace of scab. Certified seed is available and always commands a high price.

See Auckländer Tall Top for the differences between two Auckländer varieties.

FIG. 8. AUCKLANDER SHORT TOP (LEFT) AND TALL TOP (RIGHT).

(To be continued.)

USE OF LIMONITE IN BUSH-SICKNESS.

INFLUENCE OF COBALT CONTENT.

R. E. R. GRIMMETT and F. B. SHORLAND, Chemistry Section, Department of Agriculture, Wellington.

FOLLOWING Filmer and Underwood's* claim that iron-free extracts of limonite cured enzootic marasmus in Western Australia it was decided in August, 1934, to investigate the iron-free extracts of New Zealand limonites, used in the cure of bush-sickness, prepared in accordance with Filmer and Underwood's method. Half a hundredweight of Ruatangata limonite known to be effective was extracted twice with from 10 to 12 litres of decinormal HCl by standing in the cold overnight with occasional shaking. After filtration and concentration and removal of iron and silica the solution developed a bright green colour, which was found to be due to cobalt: 3·75 mg. of cobalt was found to be present in the first extract, but as the degree of acidity had been much reduced by the small amount of lime present in the large bulk of limonite a further extract was made and found to have 60 mg of cobalt present. Feeding-trials with "bush-sick" animals have been made with these extracts. The first extract gave negative results with one sheep each at Atiamuri and Mamaku, while the second extract is showing slow improvement with the same sheep- not nearly so fast as with the whole limonite. A solution of cobalt acetate fed to a sick cow at Kaharoa gave negative results, but it is not certain whether the animal was truly "bush-sick" and not poisoned with ragwort. The same solution is now being fed at Atiamuri to a sick sheep, which is slowly improving. At the same time, another very sick sheep is definitely improving on a solution of iron ammonium citrate prepared from A.R. iron-ammonium sulphate by a process specially designed to remove cobalt and other trace elements, and and from distilled ethyl citrate and ammonia. It thus appears that trace elements such as cobalt may exert a stimulating effect, or aid iron assimilation, but that iron *per se* is required, and is curative. Another trace element present in the iron-free extract of Ruatangata limonite is zinc, and a similar small experiment in this case is also showing slow improvement in a sick sheep. The field experiments to which reference has been made are in the hands of Mr. C. R. Taylor, of the Chemistry Section.

For a statement regarding the possible stimulating effects of trace elements such as arsenic and copper, see Aston, *N.Z. Journal of Agriculture*, 49, 1934, pages 84–85. Recent work has shown that the *cause* of bush sickness is not connected with a deficiency of either of these particular elements.

* Filmer, J. F. and Underwood, E. J., "Enzootic Marasmus: Treatment with Limonite Fractions," *Australian Veterinary Journal*, Vol. X, 1934, 83–92.

Tables published in the August *Abstract of Statistics* show that in 1933–34, in all, 7,570 holdings of 1 acre or more situated outside boroughs grew wheat for threshing. The average area on a holding was 37·82 acres and the average yield per acre was 31·56 bushels.

SEED-WHEAT CERTIFICATION.

CERTIFIED CROPS

UNDER the Government scheme for the certification of seed wheat, the following additional growers have seed for sale from crops which have passed both field and grain inspections. (Previous lists, to which growers are referred, were published in this *Journal* in February, March, April, and May, 1935) :—

Variety.	Grower.	Acreage.
Cross 7	*J. Brooks, Brookside	17
Hunter's II ..	C. G. Verity, Waihao Forks	7
Solid Straw Tuscan	†H. P. Brosnahan, Seadown, R.M.D. ..	5
	†R. Harris, Opaki Road, Masterton ..	10
	†F. S. Medlicott, Waimate, R.M.D. ..	19

* Contract to Canterbury Seed Co. † Passed subject to machine-dressing.

—*Fields Division*

The difference between sowing pastures down with and without a good companion crop was very noticeable recently on a farm at Waikaka. Rape was sown at the same time as the grass-seed, but in one fairly long run the rape-seed stopped running and the grass seed only was sown. On this part the sward is quite dense, while the other part is quite open. Sheep appear to appreciate the dense sward as regards grazing.

SEASONAL NOTES.

THE FARM.

Top-dressing in Relation to Production Costs.

A QUESTION which continues to be asked very much is whether expenditure on top-dressing is one of the items of overhead cost which it is advisable to reduce. The general answer given to the question by farmers favours continuance of top-dressing. This is indicated by the relatively heavy top-dressing programme which has been maintained during recent difficult trying years. Certainly some decline in top-dressing has taken place, but often farmers adopted a policy of straining their resources in order to obtain the assistance which they considered top-dressing would give. That such a policy has undoubted merit is indicated by data published in the report of the Dairy Industry Commission. A table appearing on page 16 of that report indicates that—

(1) When the butterfat-production was under 75 lb. an acre the expenditure in fertilizers was 5s. 8d. an acre, and the cost of fertilizer per pound of butterfat was 1·193d

(2) When the butterfat-production ranged from 125 lb. to 150 lb. an acre the expenditure on fertilizer was 10s 9d. per acre, and the cost of fertilizer per pound of butterfat was 0·943d.

(3) When the butterfat-production ranged from 200 lb. to 225 lb. an acre the expenditure on fertilizer was 14s. 8d. an acre, and the cost of fertilizer per pound of butterfat was 0·839d.

(4) When the butterfat-production was 250 lb. an acre and over the expenditure on fertilizer was 18s. 10d. an acre, and the cost of fertilizer per pound of butterfat was 0·803d.

These data, which relate to the 1933–34 season, are based on the information supplied to the Department of Agriculture by 550 North Island dairy-farmers. Information typical of the industry was sought, and the results that were considered proved to be typical ones, being however, somewhat better than the average. The farms reviewed were located principally as follows: 144 in Wellington Province, 80 in Taranaki, 144 in South Auckland, 115 in North Auckland. Summed up, on the farms covered by the survey liberal use of fertilizer was associated with substantially increased production and decreased overhead in respect to the cost of fertilizer as an item in the cost of a pound of butterfat. It may be noted, for instance, that in the comparisons cited above the overhead for fertilizer is 48 per cent. higher with light use of fertilizer than the relatively liberal use (1·193d. in the former case in comparison with 0·803d. a pound of butterfat in the latter case). While it cannot be deduced logically from the evidence under review that freer use of fertilizer always results in lower overhead costs in dairying, it does seem clear from the data given that many farmers in their fertilizer practice do not even approximate the probable limitations in the amount of fertilizer that may be used profitably, and that indeed there are those who use fertilizers to such a restricted extent that they hardly provide themselves with proper evidence about the results obtainable from judicious top-dressing.

It is relevant to the above considerations that the raising of fat lambs is analogous to dairying in that it is based primarily on the production of milk. As is to be expected from this, experience shows that the reaction to top-dressing is similar, whether the resultant supply of feed be devoted

to the production of butterfat or of fat lambs. In fact, normally, the influence of fertilizer can be turned into cash more certainly and more readily in the raising of fat lambs then in dairying: this is because in raising fat lambs the season of the need of additional milk-producing feed often coincides more completely than in dairying with the production of additional milk-producing feed due to top-dressing—much of the benefit of popular top-dressing results in additional fresh leafy feed in spring and summer just when the crop of lambs need the nutriment obtainable from such feed either directly or indirectly through the ewes.

Time of Phosphatic Top-dressing.

Repeatedly in these notes attention has been directed to specific advantages attaching to top-dressing with phosphates in the autumn and at times in the summer. Summed up, the main advantage of such top-dressing is not that it gives a greater supply of feed than top-dressing in the winter or spring, but that it gives a supply of feed which, because of its more even production through the year, more easily can be used effectively. Actually, varying the date of applying phosphatic fertilizer to grassland seems not to affect appreciably the amount of additional feed which results. This matter has been investigated in a limited amount of work which has been carried out in both Auckland and Wellington Provinces, and in which the pasture-growth was weighed carefully at frequent intervals. It was found, for instance, that when superphosphate at the rate of 3 cwt. an acre was applied variously in spring to one area, in summer to another, and in autumn and in winter to others, there was practically no difference in the amount of additional feed resulting in a full year on the various areas. Much the same result was obtained when the date of application of basic slag at 3 cwt. an acre was similarly varied, except that in the use of basic slag the winter (June) application consistently was slightly superior. These results are in full accord with prolonged experience in many districts where it has been found that top-dressing with phosphates may be carried out in July with good results. Where, as so often is the case, it is desired to stimulate growth rapidly, then generally superphosphate should be used Even on somewhat cold soils in the North Island, superphosphate applied in July has been found to bring about quite appreciable increases in the amount of feed available in August. Basic slag applied at this season is considerably slower in its action than superphosphate, but somewhat quicker than island and African phosphates.

Spring Top-dressing with Sulphate of Ammonia.

During recent years much consideration has been given to the application of sulphate of ammonia to grassland in the spring. In this connection the available knowledge makes it unsafe to lay down any rules for general application. Of two adjacent similar farms on one the use of sulphate of ammonia in the spring may be well justified, while it is not on the other—much depends on the prior management. When there is prospect of scant supplies of feed in August and September, generally additional feed may be obtained by the application of sulphate of ammonia about mid-July to suitable pastures. For a few weeks prior to mid-July it is probably advisable not to apply sulphate of ammonia, for it has been found not to exert much influence when plants naturally are most dormant because of cold conditions. The use of superphosphate in conjunction with sulphate of ammonia is generally advisable, and is commonly effected by the use of the fertilizer known as ammoniated superphosphate. If the pasture to which sulphate of ammonia is applied contains a considerable proportion of rye-grass and is well drained, there is greater likelihood of successful results. Frequently liming also should be associated with the use of sulphate of ammonia, even in places where no visible result from liming, alone or in conjunction with superphosphate, has been noted.

Miscellaneous Attention to Grassland.

Generally in July harrowing of pastures which have not been harrowed recently should be carried out. It is particularly advisable on fields which have been stocked heavily in May and June. Such harrowing may be made of great value in breaking up and distributing animal-droppings, and as an aid in this a section of chain-harrow attached behind the grass-harrow proper is usually valuable.

Suitable paddocks, such as ones which are well drained, provided with shelter, and containing a substantial amount of rye-grass, often should be closed up during July for subsequent reception of cows that calve early or of ewes that lamb early.

At times, and especially in districts characterized by heavy soils, a wet winter is followed in the next summer by the occurrence of hosts of weeds in pastures which previously were relatively free from them. Thistles, rushes, buttercups, and daisies are among such weeds. These weeds gain their foothold on bare patches of the soil which have resulted from the trampling of stock on wet soft fields Young pastures particularly are subject to such damage, which at times it is not at all easy to avoid in practice. One course is to avoid as far as possible the stocking of those portions of the farm which are most subject to damage from trampling during a wet period. Another course is to concentrate the damage as far as possible in paddocks which soon are to be used for arable cropping—these may well include paddocks which have suffered from the ravages of the grass-grub.

Drainage.

Certain aspects of farm drainage frequently obtrude themselves. First is the fact that the returns from certain sound practices, such as the use of fertilizer or of good seed, are at times much smaller than they would be were these practices applied to well-drained land. In the next place, drainage could often be improved materially, even though it would not be made nearly perfect, at a comparatively small cost—in some cases, for instance, the drainage of certain wet parts which catch the moisture from larger areas would give benefit out of all proportion to its cost. A further matter worthy of note is that money may readily be wasted on drainage unless it is both well planned and well executed. Though drainage is a relatively simple matter, it is not so simple as to be without pitfalls to the inexperienced, and so those without experience, as a common-sense measure, should seek guidance based on experience. Still another matter that calls for note is embodied in the view that all other effort towards improvement should be deferred until the drainage is rectified. This is fairly commonly reflected in the attitude that top-dressing is inadvisable until the land has been drained. Actually top-dressing is often distinctly profitable on poorly drained land, on which it would be more profitable were the drainage better. Similarly, instead of waiting for good drainage to enable a high-class seed mixture of the rye-grass - cocksfoot - white-clover type to be sown with success, it is at times a good policy to establish species which not only will tolerate badly drained conditions, but also yield satisfactory supplies of feed. This may mean resorting to the use of such species as meadow foxtail, *Poa trivialis*, *Lotus major*, strawberry clover, and sweet floating-grass, according to the conditions. Detailed information about suitable plants for badly drained situations may be obtained from local officers of the Fields Division.

The following general facts about drainage are at times overlooked :—

(1) The drainage of wet spots in a field is often the most profitable form of drainage that can be undertaken. In the drainage of isolated wet spots an endeavour should be made—particularly if tile drains are being employed—to locate the drains so that they may serve as part of any subsequent more comprehensive work and probably be the basis of it.

(2) In planning drainage work, the first step should be the locating of the source of the supply of excessive water. Knowledge of the source may reveal the possibility of draining an area more satisfactorily by preventing water reaching it instead of by removing water subsequently. Wet areas along hillsides or at the foot of hills often offer opportunity for the use of drains placed to intercept water in its passage to badly drained land. Drainage by interception frequently is relatively inexpensive.

(3) When tile drainage is to be provided, this should be done when the land is in grass. Then the sods of turf may be set aside for subsequent placing, with the turf down, on the joints between the tiles. Sods are of value also at the mouths of any mole drains which discharge into tiles.

(4) It is preferable not to lay tiles until the ditch has been freed of any silty material by a heavy rain.

(5) After the tiles have been placed the ditch should be filled in as soon as possible.

(6) The bottom of the ditch should be rounded and as far as possible should fit the diameter of the tile being used—this assists in avoiding displacement.

(7) A minimum diameter of 3 in. in tiles may well be adopted.

(8) In laying tiles it is particularly desirable to make them fit at the top.

(9) A useful general rule as to the depth of mole drains is to place them in the subsoil, but not more deeply than is necessary to avoid the comparatively crumbly surface soil. This depth should be determined not by the average thickness of the more open surface layer, but by its greatest thickness—otherwise the mole drain would collapse after a relatively short time in those portions of it passing through the more open soil.

(10) The heavier the land the closer should be the mole drains—usually it is not advisable to place mole drains farther apart than 9 ft., and often more profitable results would be obtained from drains 6 ft. apart.

(11) Mole drains, like other drains, function properly only if kept open at the mouths. If mole drains discharge through firm subsoil into open drains it is likely to be necessary only to inspect the mouths of moles at intervals to remove any blockages. But when moles discharge along a natural hillside terrace the openings usually are in crumbly earth which tends to obstruct the discharge of water unless proper measures are taken. One measure is to dig a ditch at the mouth of each mole until solid subsoil is reached, then lay tiles from this to the point of actual discharge and fill in the ditch.

(12) It is not advisable to employ mole drains on steep grades, where scouring would occur, or on extremely level ground. They function satisfactorily when there is a fall of from 3 in. to 4 in. in 100 ft.

(13) Level sections or depressions in mole drains involve the danger of silting, and so mole drains should pass round instead of across depressions.

(14) Mole drains usually should be made in early winter, after the subsoil has become well moistened: if the subsoil is too dry cracking of the walls, which leads to later blocking, may occur: if the subsoil is too wet a glazed wall, which means slower drainage, may result.

General Cropping.

In general, sowing of seed in July should be avoided. Spring-sown oats and wheat generally are sown in August or in early September and barley in September or early October. The cultivation for cereals which are to follow swedes or turnips—crops which often are on the land till the end of July or early August—must be pushed ahead as quickly as is possible with due regard to the undesirable effects that may come from tillage of soil containing too much water. Glazed furrows and soil clinging to boots or implements are indicative of over-wet soils. For such crops the roller can

be used advantageously on light land in consolidating the seed-bed, but on heavy lands rolling may be harmful—it may cause the soil to settle down too much and to cake. Cereals sown in the spring benefit from a rolling after drilling of the seed, but, unless the land is light, the rolling should be carried out not immediately after drilling but when the land is drier—*e.g.*, in September or early October.

As a rule cereals sown in the spring respond well to phosphates, and a dressing of 1 cwt. an acre of superphosphate in drier districts or of from 2 cwt. to 2½ cwt. an acre in districts of good rainfall may be expected to prove profitable.

If the preparatory cultivation for lucerne is not already in progress it should be commenced at an early date. Lucerne following old pasture is particularly good practice, and if it is adopted then the land should be prepared in the manner described in these notes last month.

A somewhat common misconception is that lucerne is comparatively fastidious or exacting in its requirements. Widespread field experience in New Zealand and in other countries has shown that lucerne may be grown profitably over a wide range of conditions of soil and climate provided the soils are well drained. Land which has been under the plough should be sown in lucerne only if it has been kept " clean " while in an arable state, either by fallowing, by the growing of fallow crops such as mangels and potatoes, which have really cleaned the ground, or by the growing of " smothering " crops such as oats and tares, which weaken weeds.

Winter Feeding of Stock.

Cereals sown in the autumn should be fed off before growth becomes too long. As a rule two feedings of relatively long growth are more satisfactory than a single feeding of long heavy growth, in which considerable waste is practically unavoidable. Garton oats should be eaten down once, and that quickly.

In the feeding of roots, carrots and mangels should follow swedes in the order named. Chou moellier usually is in good condition for feeding in July, when, as a rule, it should be used, for sometimes in August it tends to run to seed-stalks. Because of the watery nature of both roots and silage, it is better to feed roots and hay than roots alone, or roots and silage. The prolonged feeding of roots alone has led to disorders such as red-water.

In the feeding of stock July is generally a critical period, and especially is this true relative to developing stock and to dairy cows and breeding-ewes. Many should know from bitter experience that poor feeding of the dairy cow after calving has a dire effect upon the season's yield. It does not seem to be so well known that during the time the dairy cow is not yielding milk she should be fed liberally enough to build up bodily reserves which are drawn upon in the subsequent producing-season and which assist in minimizing the incidence of disorders that occur all too commonly at about calving-time.

Recent New Zealand work has shown that the economical production of fat lambs is determined to a considerable extent by obtaining lambs of satisfactory weight at birth, and that the weight of lambs at birth in its turn is determined by the feeding of the ewes during the winter. Further, extensive work shows that a completely analogous position obtains in pig-raising.

While it may be difficult to make economic emergency provision of feed for the current winter, the above facts provide guidance as to the steps relative to special feed provision which should be taken in preparation for future winters.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Manures and Cover Crops.

THE following elementary facts regarding the fertility of the soil must be given their due consideration before any system of manuring is decided upon. Soils are made up of inorganic matter (minerals) and organic matter, which might generally be termed decayed vegetable or animal matter. In the latter is contained most of the nitrogen. Impoverished conditions in the soil may be brought about by improper cultural practices, unfavourable weather, or by continuous cropping with the same class of plant. Excessive cultivation, especially during dry periods, will rapidly destroy the organic matter in the soil and so dissipate the supply of nitrogen. Three substances essential in soil-fertility are nitrogen, phosphoric acid, and potash. These three substances combined in one material are what is commonly known as a complete manure.

As the soil texture and fertility vary in different localities, so must the application of manures be varied if the best results are to be obtained. A liberal supply of humus (decomposed organic matter) is probably one of the most important factors in promoting healthy tree-growth. One of the best ways of supplying humus is in the form of farmyard manure. However, as farmyard manure is seldom available in sufficient quantities for general application, cover-cropping has to be resorted to. In the use of leguminous crops, such as lupins, peas, beans, vetches, and clover, a considerable amount of nitrogen is obtained from the air, and a soil liberally supplied with the humus resulting from the decay of such crops is also well supplied with nitrogen. Humus also holds stores of phosphoric acid and potash, as well as of nitrogen, which during the process of decomposition are liberated as plant foods. Humus increases the absorptive and retentive powers of the soil with regard to moisture, it opens up stiff soils and binds light ones, and is a potent factor in preventing the loss of manurial materials by drainage. Legumes are of greater value than cereals as a cover-crop in that they not only gather from the air nitrogen—which is stored in nodules in the roots—but are deeper-rooting and are able to avail themselves of food-supply from the subsoil.

Where additional fertility is required, fertilizers can be added. In most instances where trees are making poor growth and the fruit is small it may be taken that nitrogen is required. This can be supplied in the form of sulphate of ammonia. For bearing trees about 2 lb. per tree is recommended, and this should be worked into the soil as the spring growth is commencing. The excessive use of sulphate of ammonia will tend to delay the colouring of the fruit in certain varieties, including Jonathan. It should be noted that the use of this material increases the acidity of the soil. This condition can be corrected or prevented by the use of 1½ lb. of lime to every 1 lb. of the fertilizer.

Phosphoric acid usually is applied in the form of superphosphate, and potash in the form of sulphate of potash. As these fertilizers are of comparatively slow action they should be applied several months before the spring growth commences. A portion should also be applied with the sowing of the cover-crop. The amount to apply per acre will vary according to the needs of the trees. From 2 lb. to 6 lb. or more per tree for superphosphate and one-half of this amount for sulphate of potash are quantities in fairly general use. However, on certain soils and with certain classes of fruit-trees the application of phosphoric acid and potash is of doubtful value, and the advice of the Orchard Instructor for the district should be sought before deciding on any manurial programme.

Pear-tree Pruning.

To induce vigorous-growing Winter Cole and Winter Nelis pear-trees to carry heavy annual crops, the greatest success has resulted from very

hard pruning. This treatment, in most cases, consists of a drastic reduction in the number of leaders and fruiting-arms, and heavy thinning of fruiting branches and spurs, and a hard cutting of the current season's growth. Where this treatment has been given and followed up with similar pruning each year, heavy annual crops have been general.

Grafting.

The scions for grafting should be selected at pruning-time from trees of known bearing habits, the wood should be well ripened, free from pests and diseases, and should be of the past year's growth. As the scions will not be required for some time, they may be kept in good condition by being laid on the ground in a shady situation and kept covered with a damp sack.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

Now that the winter months are upon us, growers are again reminded to prepare for the danger of frost damage in those localities where frost is likely to occur. Instructions in the means of combating frost have been given from time to time in previous notes.

Another important work which calls for attention at this time of the year is the guarding against excess water at the roots of established citrus trees. Under-drainage is one of the principal essentials, and even where this is considered to be adequate excess water is apt to accumulate during the rainy season. The removal of excessive water can be accomplished by opening up a furrow from low-lying areas, or by the use of a temporary drain made with a spade.

The harvesting of lemons which have attained the correct size should now be done, and the fruits put away for curing and storage. At this season of the year lemons which are left on the trees to become ripe are most susceptible to citrus brown-rot, readily becoming affected with it after harvesting.

To guard against brown-rot, Bordeaux mixture 3-4-50 should be applied, and whenever diseased fruits are found they should be collected and destroyed.

The season for harvesting Poorman oranges is now approaching. All fruits do not attain the yellow colouring at the same time, and this necessitates several pickings. All fruit should be handled carefully to prevent damage from bruising and from skin-punctures, which rapidly lead to decay. All stored fruit should be examined frequently, as decay is more prevalent than when the fruit is gathered under drier conditions.

L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Preparations for New Season.

If the best results are to be secured during the coming season it is essential that the stock, plant, and equipment should be in good working order. The incubators and brooders should be examined carefully, special care being taken to see that they are in good order, for a defect such as a loosely fitting door has been the cause of many disappointing hatches, and perhaps a little attention to such a defect now may mean more and better chicks during the next few months. Repairs to fences, gates, doors, nests, feed-troughs, &c., if not attended to now, are likely to be left to cause much inconvenience and perhaps annoyance during the coming busy season.

The cleaning-up of the plant and the sweetening of the runs by digging them over and planting some quickly growing succulent green feed will all help to obtain the desired results, and if such work is done now the poultry-keeper will have more time later on to give to that important work of hatching and rearing the new flock.

It is wise always to have an extra feed-trough on a poultry-plant, and, in fact, a great number of poultry-keepers fail to appreciate the advantage of providing sufficient troughs so that all birds in a flock can feed at once in comfort. The greatest drawback in not providing plenty of trough-space is that at feeding-time some birds crowd on top of others in an endeavour to obtain sufficient feed, with the result that the strongest and largest birds secure the greatest amount, while the smaller birds often do not get sufficient.: especially is this so if the feed provided is not as liberal as it should be, and if the growing stock are not graded according to size. It is not realized generally that lack of feeding-room is one of the reasons why at times so many birds of different sizes are seen in a flock of growing stock of the same age, and why so many pullets go into a false moult after having laid a few eggs. A good rule is to allow each laying pullet about 3 in. of trough-space.

Mating-time.

Generally speaking, August and September are looked upon as the best months of the year for hatching—August for the heavy and September for the light breeds—and therefore it should be the endeavour of all, both large and small producers, to have the required number of chickens hatched out before the end of September.

Though eggs may prove fertile from five to seven days after the stock have been mated, it is much more satisfactory to mate some time before the eggs are required, and there should be no delay now in doing this work. The breeding-hens should have been selected during February or March, but before mating them they should all be handled carefully and examined, firstly for insects, and if necessary treated, secondly for condition or for any signs showing want of vigour or constitution, for some hens that appeared to promise to be good breeders when selected during February or March do not come through the moult well, and lose condition, while others again put on too much condition and such birds are better out of the breeding-pen.

As the breeding-birds are the foundation of the poultry industry, the more care taken and knowledge shown in their selection the better. Purity of blood, vigour, and constitution, with capacity to produce and reproduce, are the chief things to look for.

The best and most promising specimens will show the following characteristics. Head fairly fine, showing strength and character; eyes bold, large, and prominent; face free from wrinkles and feathers; comb of medium size and thickness, but not coarse or flabby; wattles of medium size, fine, and close together; legs rather short, of flat bone, set well back and wide apart; well developed crop; deep, full abdomen, which should be soft and pliable to the touch (this is a very important point). The body should show length, depth, and width. A good width across the back is a character which specially should be sought in breeding. In general appearance, the good breeder's body will be of a wedge shape, not unlike that of a good milking-cow.

The aim of all poultry-keepers should be to breed birds of a uniform type, and in order to do this it is necessary to have some model to guide them. White Leghorn breeders would do well when selecting their Leghorn hens to take as a model the good White Leghorn breeding specimen as illustrated on page 50 of the Department's Bulletin No. 66, "Utility Poultry-keeping." This publication is procurable from the Publisher, Department of Agriculture, Wellington, price 1s. per copy, postage free.

The selection of the male bird is of great importance, as he leaves his influence on all the chickens—he is really more than half the flock and he should have come from parents of quality, of good robust constitution, and from a mother that produced eggs of good uniform shape, size, and colour, for the future stock can be expected to possess these very desirable qualities only when they have been inherited by the birds for generations.

Few, if any, birds in a flock are free of all faults, but in choosing the male it is advisable to see that he is strong where the hens are weak, or *vice versa.*

The production of small eggs is becoming a serious matter with some poultry-keepers, and the only way to correct this defect is to see that no hen goes into the breeding-pen unless she produces eggs of a good uniform shape, size, and colour.

As a rule a small bird lays small eggs, and, in fact, some poultry-keepers seem to favour the small hen and consider that a bird must be on the small side to be a good layer. This is a mistake, for smallness is really not the cause of great egg-production, but its effect. The general tendency is for the average size of the birds in a flock to get smaller each generation, and it is well therefore to watch this matter and select for the breeding-pen birds of a somewhat larger type than is usually found with the greatest egg-producers. The novice should always keep in mind the fact that if when selecting breeding-birds too much attention is paid to egg-production, and not sufficient notice given to the paramount importance of vigour and constitution, a heavy penalty will have to be paid sooner or later.

The feeding of the breeding-stock is an important matter, and the aim should be to feed in such a manner that the birds will be in the best condition to produce eggs containing the maximum amount of fertility and vitality. The birds should not be allowed to get too fat, but, at the same time, they must be kept in good condition although not forced for heavy egg-production.

There are many different systems of feeding breeders, and many successful poultry-keepers have their own method. The following system has been in use for a number of years, and is still being used successfully: When the breeders are selected in March, they are separated from the rest of the flock and fed on a grain mixture night and morning, the mixture being made up of (by measure) three parts wheat, one part barley, and one part yellow maize. This is fed in deep litter, and as much is given as the birds will clean up greedily. No mash is fed until about a month before the eggs are required for hatching purposes, when a mash is fed each morning (instead of grain) consisting of (by measure) two parts pollard, one part bran, three-quarter part of finely-cut succulent greenstuff, and 3 per cent. of the entire mixture of meat-meal, the lot being mixed fairly dry with skim-milk, and as much fed as the birds will clean up in fifteen minutes.

Oyster-shell and metal grit and clean water should be within reach of the birds at all times.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

The Dormant Season.

DURING the months of June and July activities in the apiary, so far as the bees are concerned, should cease. No advantage is to be gained by interfering with the bees, provided that the colonies have been left with ample stores, that the queen is right, and that there is an adequate supply of mats to conserve the heat of the cluster. After heavy rains it is advisable to remove the roofs to ascertain the condition of the mats, and if any are found to be damp they should be removed. This can be done without disturbing the bees. Damp mats should not be tolerated, as they are harmful to the health of the bees at all seasons of the year, and more particularly during the winter months when dormant colony-conditions obtain. As advised previously, a plentiful supply of mats should always be on hand.

Moving of Bees.

Providing sufficient care is taken, bees may be moved long distances with perfect safety at this season. It is not advisable to delay this work until

the spring, as brood-rearing will then have commenced in earnest, and the numerical strength of the adult bees will be greater than at this period. Moreover, there is little brood in the hives to be injured. When moving bees short distances—*e.g.*, up to a couple of miles—little preparation is necessary beyond screening the entrance with wire gauze and fastening the bottom-boards and roofs with crate staples or battens. It is well to choose a cold night before closing the entrances of the hives to be removed. On arrival at the new location the bees should be allowed to settle down prior to removing the gauze. It is quite a good plan to place some obstruction—a piece of board will suffice—in front of the entrance, as this will cause the bees to investigate and take new bearings. Some such action is necessary to prevent the field-bees from returning to the old location.

When removing bees long distances, which may necessitate their confinement to the hives for a lengthy period, it is essential that they be well packed so as to allow of ample ventilation. To safeguard against suffocation of the bees the hives require to have wire screens top and bottom. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions as a hive-body, and covering this with wire cloth. When placing the screens on the hives proceed as follows :—

The evening before removal, after the bees are all in, place a frame alongside each hive level-side up. Gently lift the hive on to the frame. Next remove the cover and mat, and place the upper frame level-side downward in position. The bees being now secure, the battens to hold the frames can be nailed on the following morning. Place a hive-cover over the frames in the event of rain falling during the night. When railing bees, the frames should run parallel with the truck, but with road transport the reverse should be the case. This rule should be followed to prevent the frames from rocking and thus killing the bees.

It is well to remember that, as a precaution against the spread of disease, bees should not be removed a distance of more than 10 chains without the written consent of an Inspector. Failure to obtain the necessary consent renders a person liable to a fine not exceeding £25.

The Winter Overhaul.

During the winter months, as opportunity offers, the working-plant of the apiary should be carefully overhauled. The engine, extractor, and tools should be examined, and defective or broken parts replaced, so as to have all in readiness for next season's work. It is not wise to leave the repairing and painting of spare roofs, hives, and bottom-boards until they are to be brought into use. Now is the best time to lay down future plans ; and if an increase in the number of colonies is decided upon, or the establishment of an out-apiary is being considered with the object of increasing income, no time should be lost in getting together the required number of extra hives, supers, roofs, and bottom-boards, and in the preparation of frames and the fitting of comb-foundation.

E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

GOOD seed, suitable manurial treatment of the land, and crop rotation are some of the main factors in the economical production of vegetable crops. Land that has been grazed for a number of years and has recently been well broken in will usually carry good crops, with ordinary attention, if good seed-strains are planted. After two or three years of intensive cropping, manurial treatment and rotation become of increasing importance. Organic as well as inorganic or artificial manures are then necessary to obtain good results. With thoughtful management good results may be obtained over a long period on heavy land ; but sometimes light land should be sown

down and grazed after a few years of cropping, so that it may regain its condition. This is necessary more particularly where organic manures are scarce.

Useful organic manures are farm and stable manure, fish and meat meal, blood and bone, poultry manure, and soot, seaweed, and plant growth of any kind that is free from serious diseases and that readily decays in the ground. Too often much of this valuable material is lying round in an untidy manner and is wasted by being dried and leached in sun and rain, after which even the residue is wasted. Stacked in a pit or on the surface of the ground, and covered with soil, it is in a few months sufficiently rotted for spreading on the land and ploughing under—where it is the indispensable basis of fertility, especially where continuous cropping is to be done. This treatment does not apply to fish and bone meal, which are dried and ground—a method which is also sometimes applied to poultry manure. Soot also is usually stored in a dry place under cover for a few months before use; and green cover crops are usually turned under where grown so soon as they commence to flower. But stock-manure of all kinds, especially where they have been bedded down with straw or bracken, weeds, and rough growth cut before seeding, seaweed, and any cheap organic refuse should be placed in the stack and fermented. Under good management in this climate, land of fair quality and condition, receiving a liberal dressing of this material during the winter every other year and artificial manures as required, will produce good crops under intensive culture for a long period.

The inorganic or artificial fertilizers, also organic manures such as bone and fish meal that are ground to a fine state of subdivision, are usually broadcasted on the land and worked in by cultivation two or three weeks before planting or sowing. More slowly acting fertilizers, such as basic slag, which is a useful form of phosphate for a change, especially on heavy land in a wet climate, and kainit, are applied in the early stages of the preparation of the land; while the more quickly acting manures, such as nitrate of soda, are withheld and usually applied as required when the plants are established. Lime is also an important factor in treatment, especially on heavy acid soils, where it is effective in producing the friable condition which is so desirable, and also assists the action of fertilizers. Some crops have a marked preference for the neutral or alkaline state of the soil, which may be obtained on acid soils by the use of lime. They include the cabbage and related plants, such as cauliflower, Brussel sprouts, radish, and turnips; also parsnips, beetroot, salsify; spinach, lettuce, asparagus, rhubarb; onions, peas, and beans. Ground carbonate of lime—that is, unburnt lime—is in general use, and if it is of good quality and very finely ground it is quite satisfactory. It may be applied at any time, but to best advantage in the early stages of the preparation of the land. On most of our heavy lands it is indispensable for this class of cropping, but on the lighter lands it must be used with judgment.

Most crops are heaviest when grown on land which has received a heavy dressing of organic manures during its preparation, but root crops of most kinds are coarse and unshapely when grown immediately after a heavy dressing of organic manure; hence crops must be classified and given the conditions that suit them. The use of lime is another reason for rotating crops. The diseases to which crops are liable vary, and as, in most instances, the land becomes contaminated, rotation of crops to a great extent avoids the perpetuation of disease. For these and other reasons a carefully thought-out system of cropping facilitates the work and gives greatly improved results.

Established crops of asparagus are dressed with manures in early spring and at the completion of the cutting-season. Besides a partiality for alkaline conditions, they thrive on nitrates and potash, which are the artificial manures of most importance. A reasonable amount of phosphates should also be included, and the humus-content of the soil must always be

maintained. A dressing of phosphates and potash may be broadcasted and disked in now, and two or three dressings of nitrate of soda applied during the months of August and September after growth has started.

Established crops of rhubarb require somewhat similar treatment. Nitrate of soda, 2 cwt. to the acre, may be applied after the first pulling in spring and another application when pulling has finished for the season; on heavy land sulphate of ammonia is a more suitable form in which to apply the nitrogen.

Seed-potatoes now require light and air, but should be protected from frost. With suitable light, air, and protection they produce short, strong sprouts and are in the best condition for planting. Any that produce spindle shoots or show other signs of disease should be discarded. Virus diseases are most prevalent in warm districts, and when stocks become seriously infected they should not be planted, but fresh certified seed obtained.

In the hands of a discreet cook garlic is a useful vegetable, and shallots are mild and tender and most suitable for pickling. Both may be planted now, when the land is in suitable condition; they produce heavy crops with little attention. It is seasonable to plant also cabbage and cauliflower and early potatoes if a warm spot is available. Old stools of rhubarb now may be cut into pieces with one or two good buds and planted with the point of the bud 2 in. deep. This is sometimes done later, after a moderate crop of sticks has been pulled. Sow radish, cress, lettuce, and spinach; broad beans, peas, and shorthorn carrots towards the end of July. If fresh stable manure is then obtained and prepared for a hot-bed it will be ready two or three weeks later for raising tomato and other half-hardy plants for setting out in October and November.

In the unheated glasshouse the tomato is planted out towards the end of July or August according to climate. The chief factors which produce a satisfactory crop are a clean house, well-prepared soil, and good plants. The first—a clean house—is best obtained by taking the matter in hand immediately a crop is finished: if modern methods are then thoroughly applied they will be found most efficient. The preparation of the land and raising the plants are the subjects now requiring most attention.

In not a few instances on heavy land the drainage is unsatisfactory, and good results rarely will be obtained under such conditions; better and earlier crops may be expected where this is rectified. Much has rightly been said regarding the injury caused to this crop by applying heavy dressings of stable manure and making the land rich in humus and nitrogen and causing the plants to be rank, unfruitful, and prone to disease. But on light land there easily may be too little humus, and even on heavy land humus is sometimes lacking where steaming is frequently practised. The very easy tendency to run to either extreme is to be carefully avoided; very good judgment is required in preparing land for any crop. Usually a green crop turned in every winter will keep the land sufficiently supplied with humus, or, in its absence, a dressing of stable manure every other season may meet the requirements. The tomato crop does not specially require a neutral or alkaline soil, but it is important that the soil be friable, and for that reason a dressing of finely-ground carbonate of lime is often an advantage. Such applications as have been mentioned should be applied early in the preparation of the soil, and two or three weeks before planting such artificial manures as may be required should be worked in. These usually consist of phosphates and potash: ¼ lb. fine bone-meal and 2 oz. each of superphosphate and sulphate of potash to the square yard is often found sufficient with liberal summer feeding after the fruit is set. If the land is rich in nitrogen a double application of potash would probably be an advantage for this crop.

In the absence of rainfall the land under glass is usually rather dry at this season, and a thorough watering is required two or three weeks before setting out the plants so that it may be in condition for this operation. Soil and subsoil should be thoroughly moistened, and it may take two or three applications of water to obtain this condition.

Good plants are of a suitable variety and strain and free from disease: usually the quality of the plants for this class of work is reasonably good. They should be taken into the house a day or two before planting, and, when the latter operation is done, set deep without drawing the soil round the neck of the plant, and, when the house is planted, settled in by an application of tepid water. Crowding is sometimes done with a view to getting a big crop, but this too often defeats its object: the tomato is partial to light and air—24 in. by 12 in. is as close as it is safe to plant tomatoes, and 30 in. between rows is more desirable, especially in humid localities. Some growers prefer to plant close and wide rows alternately: they may then be 21 in. and 27 in. respectively. A temperature of from 55° F. to 60° F. should be maintained at this stage, and it is well to avoid high temperatures during the day, which make the plants more susceptible when a low temperature has to be fought at night.

Small and Sundry Fruits.

Where small and sundry fruits are to be planted the preparation of the land should be continued without delay when the soil is sufficiently dry for working, as it is advisable that the soil settle with a well-graded surface before planting is done. Planting is done only under similar conditions, and it is important to set plants at the same depth as they were grown and to tread them in until they are quite firm in the ground. For strawberries especially should the land be firm with a well-graded surface. If the land is not quite clear of couch grass and other bad weeds, crops of this class should not be planted, but potatoes or other annual crops should be grown until the preparation in this respect is quite satisfactory. Drainage also is a matter with which it is unwise to temporize where these perennial crops are to be grown.

The Homestead Garden.

Success in horticulture depends chiefly on thoughtful planning and timely execution, for nature will take no excuses. New gardens are completed, or alterations are made in established gardens, during the autumn, the final operation being the planting of trees and shrubs at the end of that period. The only other opportunity of doing this satisfactorily is during the springtime, when lawns may be sown down about the month of August and planting completed about the month of September. Where work of this kind is to be done it should now be pushed along without delay in fine weather, as a reasonable period must be allowed in most instances for land to settle; or, as an alternative, the land may be consolidated with considerable labour. The best horticultural literature, which may be seen in most public libraries, contains many useful suggestions and clever plans for the home garden.

Many people with established gardens fail to realize the many opportunities for improvement which the present season affords. In most instances a few removals and additions in trees and shrubs would open up a view, screen unsightly objects, and add interest to a border. Or a plant border may be removed and grassed down and another cut and prepared elsewhere. In the garden, as in the forest, there is no finality, and the established garden can usually be gradually remodelled in any direction that is desirable.

W. C. Hyde, Horticulturist, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FEEDING-VALUE OF KARAKA BERRIES.

K. A. M., Ngapotiki :—

Could you give me any information regarding the feeding-value of karaka berries for sheep ? My lambs live largely on them for a period after weaning every year. This year the lambs are doing fairly well, and are in good condition, but do not grow much on berries, either in carcass or wool.

The Live-stock Division :—

The feeding-value of karaka berries for sheep has not been ascertained. At the same time it is safe to say that the fleshy part of the berries which is being eaten by your lambs has a composition very similar to that of any other berry and similar in many respects to that of the ordinary apple. Such fruits contain a high percentage of water, the dry matter being mainly composed of carbohydrates, the percentages of protein and fat both being low. As evidenced by the lack of growth in your lambs, it appears as if there is a deficiency of protein in the diet. The addition of a protein-rich concentrate such as linseed would assist materially in balancing the diet. The kernel of the berry which contains the poisonous properties is apparently not being eaten by the lambs.

EFFECT OF RAGWORT IN SILAGE.

F. J. E., Bulls :—

Some say that whilst a certain amount of ragwort in hay is not injurious to cattle, as they decline to eat it, this is not so with silage as they cannot then separate the ragwort from the remainder of the silage. Does ensiling destroy the poison in the ragwort ? If there is danger the remedy would appear to be to cut the grass early in the season before the ragwort reaches the flowering stage, which is held to be when it becomes dangerous.

The Fields Division :—

In the case of hay containing ragwort stock discriminate and generally sort out most of the ragwort, leaving it behind unconsumed. To some extent the same occurs in feeding silage containing ragwort, but naturally it is much more difficult for stock to discard ragwort from silage. In one instance silage containing upwards of 20 per cent. of ragwort was fed to guinea-pigs at the Wallaceville Laboratory without any ill effects, and, in consequence, similar silage was subsequently fed to a herd of dairy cows in Taranaki without any bad effects. In this instance it was observed that the cows were inclined to discard as much of the ragwort as possible, and on this account the owner was advised to allow the animals a liberal ration so that they would be encouraged as much as possible to leave the ragwort unconsumed. The bad effect on stock from eating ragwort is more or less cumulative. There is no evidence that young ragwort is less dangerous than ragwort in seed-head. As prevention is always better than cure, every endeavour should be made to eradicate or at least lessen the amount of ragwort by the use of sodium chlorate.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 16th May, 1935, to 30th May, 1935, include the following of agricultural interest :—

No. 72686 : Latch for door in cow-bail ; H. E. Wills. No. 72824 : Spraying-machine ; J. Gilmour. No. 73679 : Dry-cleaning eggs ; A. Davidson. No. 73680 : Destruction of pest ; Hart and Co. Pty., Ltd. No. 73697 : Cooler ; J. R. Miller. No. 72119 : Leg-holder for cow ; A. C. Beer. No. 72219 : Cheese-manufacture ; W. H. Udy and W. C. Dixon. No. 72311 : Tine-harrow ; J. A. Thorne. No. 72742 : Vat-cover ; A. E. Denham. No. 73161 : Fencing-post ; A. M. Blackler. No. 73724 : Churn and butter-worker ; Challenge Cream and Butter Association.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

WEATHER RECORDS: MAY, 1935.

Dominion Meteorological Office.

NOTES FOR MAY.

DURING May there were two periods when fine and mild weather prevailed generally—namely, between the 11th and 15th and from the 25th to the 27th, but the remainder of the month was mostly cold and unsettled, with a predominance of southerly winds. Owing, however, to a particularly favourable autumn, and also to the two mild periods above referred to, there was a good growth of pasture, and generally a plentiful supply of winter feed appears available. Consequently, stock kept in good condition, although the cold spells experienced detrimentally affected the milk-yield and there were also some small losses of sheep.

Temperatures.—Whereas in the preceding six months temperatures were above normal over the greater part of the Dominion, during May there was a definite change to wintry conditions, and, except in the far North, temperatures were everywhere below normal, the largest difference being in eastern areas, where they ranged between 1 and 2 degrees below.

Rainfall.—Rainfall was below the average in parts of the Auckland Province and in the east coast areas between East Cape and Otago, but over the remainder of the Dominion it was above, the excess being greatest on the west coast of the South Island and in the Wairarapa.

Sunshine.—On the other hand, sunshine was generally below normal in eastern districts and above in western, although totals did not differ greatly from May averages. Tauranga registered 183 hours bright sunshine, Nelson 169, Blenheim 163, and New Plymouth 159 hours.

Storm Systems.—On the 1st an unusually deep depression moved on to the Dominion, its centre crossing the southern districts during the night. Pressure remained low to the eastward, however, until the 9th, while an intense anticyclone was moving very slowly across the Tasman Sea. Consequently, throughout this period cold southerly winds persisted, reaching gale force in many places.

Between the 4th and 6th conditions were particularly boisterous, a southerly gale being accompanied at times by heavy hail and sleet showers. On the 5th there were heavy snowfalls on the ranges of both Islands, and a considerable amount also occurred on the low country. In Taranaki as much as 2 in. fell on the flat in places where snow so early in the winter is almost unprecedented.

By the 9th the front of an anticyclone had moved on to New Zealand, and then followed several days' fine weather.

From the 16th to the 21st a series of intense westerly depressions crossed the Dominion, and strong and squally north to west winds prevailed. Rainfall at this time was confined chiefly to western districts, where some heavy falls caused floods in the rivers, particularly in Westland, on the 18th and 19th. On the morning of the 20th a violent north-westerly gale which swept Canterbury caused widespread damage.

During the night of the 21st the last of this series of depressions crossed the Dominion, and another southerly storm swept the country, accompanied by bitterly cold weather. Severe thunderstorms occurred in the Taranaki and Wellington districts on the 21st, and heavy rain and floods were experienced in many parts of these areas. The southerly continued to be strong in the central districts during the 22nd and 23rd. The Wanganui district experienced a severe gale on the morning of the latter day.

From the 24th until the 28th the weather was fine and quiet, with high pressure ruling. A cyclonic depression was, however, moving from the North down the west coast, and from the latter date until the end of the month dull, misty weather prevailed. Fairly general rain fell during the night of the 28th.

RAINFALL FOR MAY, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·78	21	1·30	6·61	28·39	21·56
Russell	8·34	16	1·72	7·07	45·55	20·84
Whangarei	4·93	20	1·20	7·88	32·36	25·06
Auckland	4·24	15	0·75	5·15	25·55	18·84
Hamilton	..	..	..	4·70	..	18·79
Rotorua	4·03	19	0·93	5·69	28·44	21·62
Kawhia	..	..	..	5·34	..	19·82
New Plymouth ..	7·55	17	1·59	6·20	34·09	22·59
Riversdale, Inglewood ..	11·43	17	2·41	9·69	52·23	38·38
Whangamomona ..	..	..	..	6·84	..	27·81
Hawera	4·94	12	1·25	4·58	25·99	16·98
Tairua	3·88	13	1·04	7·08	32·78	26·59
Tauranga	4·88	17	1·49	5·10	27·91	21·53
Maraehako Station, Opotiki	9·04	15	4·20	5·70	36·03	22·13
Gisborne	3·39	18	0·91	5·36	18·06	20·01
Taupo	3·99	17	1·00	3·95	22·47	16·80
Napier	2·55	14	1·50	3·18	19·41	13·16
Hastings	1·84	15	1·03	3·29	16·01	13·56
Whakarara Station ..	3·38	12	1·92	..	24·74	..
Taihape	4·68	19	1·34	3·46	15·98	14·43
Masterton	6·71	22	3·40	4·04	14·15	15·18
Patea	6·10	13	1·54	4·15	24·34	17·16
Wanganui	4·26	12	0·91	3·34	19·64	14·33
Foxton	4·93	15	1·76	3·19	14·52	11·88
Wellington	3·50	19	0·61	4·10	14·35	16·58
South Island.						
Westport	10·17	19	2·13	8·35	40·71	37·65
Greymouth	11·78	18	1·86	8·10	47·40	40·76
Hokitika	13·87	16	2·44	9·58	59·52	45·87
Ross	16·88	15	2·96	9·83	57·44	54·04
Arthur's Pass ..	19·19	10	5·60	12·78	73·61	65·41
Okuru, South Westland	10·35	8	3·95	10·80	59·74	61·32
Collingwood	16·53	16	5·37	8·87	42·36	34·80
Nelson	3·66	14	1·96	3·26	21·31	14·81
Spring Creek, Blenheim	3·41	11	1·43	3·03	11·92	11·53
Seddon	..	..	..	2·83	..	10·23
Hanmer Springs ..	4·92	15	0·73	4·54	15·48	18·38
Highfield, Waiau ..	1·66	6	0·72	3·25	10·04	14·27
Gore Bay	1·25	14	0·22	3·41	8·70	13·18
Christchurch	4·01	14	1·49	2·62	8·44	10·10
Timaru	0·95	8	0·37	1·48	8·94	9·39
Lambrook Station, Fairlie	..	..	..	1·57	..	10·12
Benmore Station, Clearburn	2·01	14	0·45	1·79	12·43	10·99
Oamaru	1·35	12	0·45	1·60	9·52	9·00
Queenstown	3·42	16	0·98	2·59	17·23	13·13
Clyde	0·99	9	0·25	0·99	8·22	6·84
Dunedin	4·01	18	0·66	3·10	16·74	14·94
Wendon	3·52	17	0·59	1·98	17·60	12·89
Balclutha	2·93	12	0·49	1·92	15·26	10·72
Invercargill	4·71	20	1·14	4·36	23·80	19·67
Puysegur Point ..	7·63	20	0·87	6·67	38·19	35·67
Half-moon Bay ..	4·76	22	1·29	4·85	24·77	24·22

New Zealand Department of Agriculture.

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FARMING IN THE AUCKLAND PROVINCE.

OBSERVATIONS ON FARM-MANAGEMENT METHODS

P. W. SMALLFIELD, Fields Superintendent. Auckland.

(Continued.)

RODNEY COUNTY.

June 11th, 1934. Makarau to Wellsford.—Mostly sandstone hill country and large farms: hills have been grassed after surface-sowing, and there is a good deal of reversion to bracken fern and manuka. There has been some summer burning of danthonia on the hills, and the burnt areas are now a bright green and make a striking contrast with the unburnt areas of dry tufty danthonia. The rank summer growth must be taken off danthonia pastures each autumn if a reasonable pasture production is to be obtained—leaving the rank growth on will eventually thin out the danthonia plants. Two courses are open—one to burn, and the other to clean up the rank growth with young hungry cattle. Burning is the easiest, but it quickly converts the pastures into pure danthonia swards. If rye, cocksfoot, dogstail, and clovers are to be kept in the pastures, the fire-stick must give place to cleaning up with young and hungry cattle. Early maturity of run cattle on a great deal of hill country is impossible, as the cattle are the scavengers that clean up rank danthonia and crush out bracken fern. It is only young and hungry cattle that will do this work. Herefords and Shorthorns are the common beef cattle in the North, but one sees many Jersey-cross steers on the smaller grazing-runs, although this class of cattle hardly can be very profitable.

At Wellsford there are three lime-works busy crushing agricultural lime; it is a soft rock containing from 70 per cent. to 80 per cent. calcium carbonate which can be easily ground to a fine powder. Since basic slag became dear, lime is being used increasingly in North Auckland, and superphosphate and lime is now the common top-dressing mixture. Most of the clay soils respond to lime and superphosphate, and some give quite a good response to lime alone.

Just past Wellsford the gum land starts again. The misty rain, which had been falling since early morning, had now cleared up, and the country was enjoying a spell of warm sunshine. A mob of Jersey-cross calves running on the unimproved gum land covered in manuka and danthonia had come out of the scrub to an open patch of danthonia

to enjoy the warmth of the sun. They were a poor mob of calves, evidently turned out in the scrub to die or survive as best they could. With the dry danthonia and the shelter of the manuka the stronger ones will come through satisfactorily, but most of the weaker ones, already showing an unhappy condition of stomach-worm infection, probably will die. Wet heavy land with swampy patches—and this land is common throughout the North—makes it often difficult to rear good calves unless they are regularly dosed for stomach-worms right from the time they are on the bucket. It is still somewhat common to turn them out on the dry danthonia hills, but adequate supplementary hay feeding is also necessary if the calves are to come through the winter in good condition.

OTAMATEA COUNTY.

March 6th, 1934: Mangawai to Tokatoka.—Mangawai is a small village situated on a tidal-river harbour on the east coast. I was first here about twelve years ago, when Mangawai was a fairly busy place and all the flats round the village were being dug over for kauri-gum. Small gum was extracted from the soil and plant debris by washing. Deep parallel trenches were dug a few yards apart and the spoil from these trenches was thrown out on the intervening land; the soil was then passed through long rotating riddles and washed with water pumped out of the trenches. The water carried off the soil and left the gum and plant debris. All this gum digging and washing work is now finished, and only here and there can be seen the marks of the old workings.

Otamatea County stretches right across the northern peninsula from Mangawai on the east coast to the eastern shore of the Kaipara Harbour. The land surface of the country consists of rolling hills of claystone, sandstone, and limestone, with isolated areas of volcanic soil. In journeying across the country one is struck by the sparseness of settlement, the large size of holdings, and the large areas of vacant unimproved scrub land. There is much gum land lying in an undeveloped state, although on these gum lands there has been considerable development since I was first through the country. From Mangawai to Kaiwaka there were several areas of ploughed and fallowed land which were just ready for grass-sowing, and to which lorries were delivering crushed limestone from Wellsford. Two things have hindered development—lack of permanent water on a great deal of the country and road-transport conditions. The solution of the first difficulty will come in time, but the primary necessity for close settlement is an adequate supply of good water. The water-dams made in the valleys which are seen here and there over the country cannot be considered really good sources of water. Too often they become breeding-grounds for internal parasites in stock, and to be safe as supplies of water for farm purposes the catchment areas should be fenced from live-stock. Transport difficulties are now practically at an end, for there has been a wonderful improvement in the roads during recent years. For instance, the now well-metalled road from Kaiwaka to Mangawai was twelve years ago a poor rutted clay road, only negotiated with great difficulty by the old coach which plied between the two places.

The limestone soils are generally good, and the presence of ratstail grass on the roadside is a fairly sure indication of soils overlying limestone. Ratstail will not tolerate very cold conditions, and its climatic

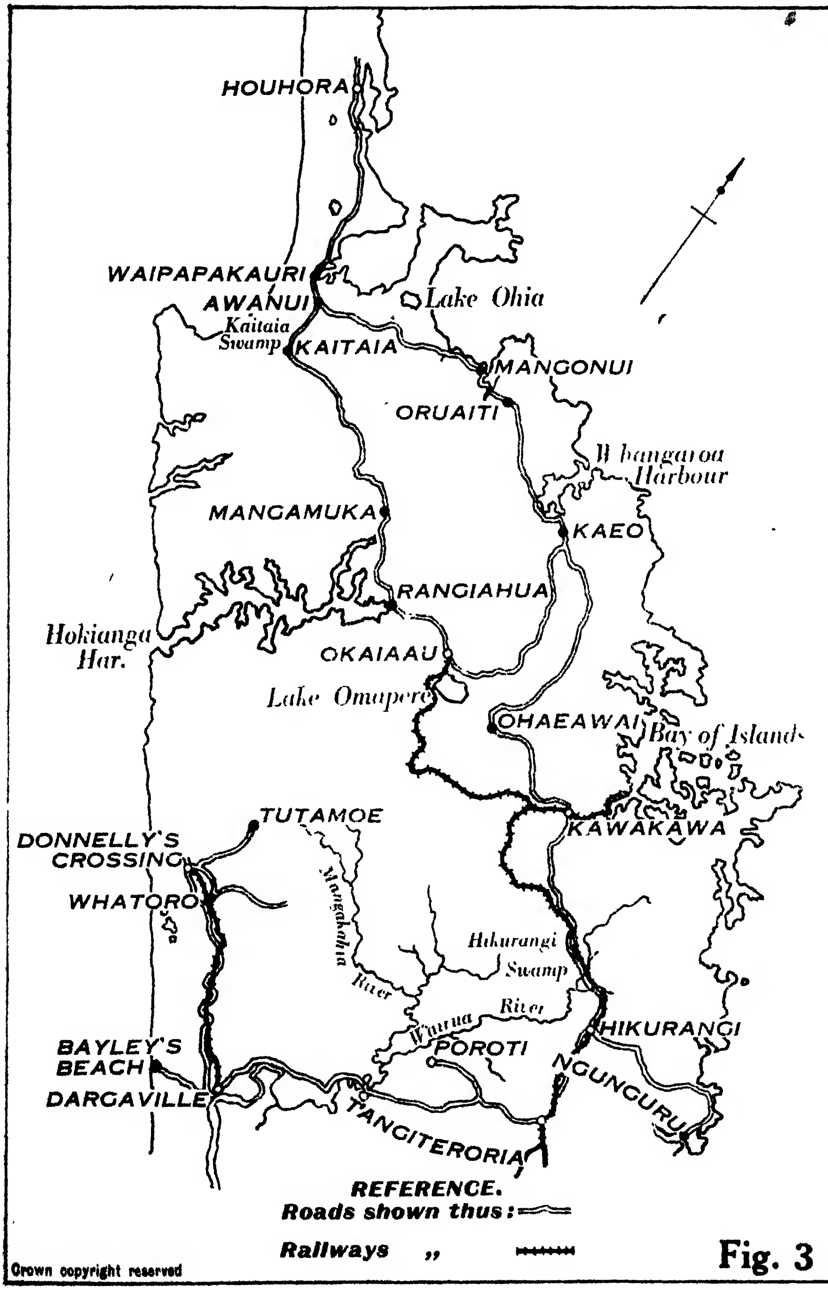

FIG. 3. JOURNEY IN WHANGAREI, HOBSON, BAY OF ISLANDS, HOKIANGA, WHANGAROA, AND MANGONUI COUNTIES.

range is somewhat similar to paspalum. At one time most of the pastures on limestone soils about here were ratstail, but during recent years the pasture swards have been improved considerably. Large areas have been cleared by late autumn and winter burning, thus exposing the crown and any fresh growth to the frost. The burnt areas were then surface-cultivated, grass and clover seed sown, and the land top-dressed. Paspalum, rye-grass, and white clover are becoming increasingly important constituents of the pasture swards.

September 18th, 1934: Maungaturoto to Tara.—A fine day, and pastures everywhere show the rich green colour that accompanies the beginning of the spring growth of grass. The country through here consists of rolling hills of sandstone, limestone, and claystone: here and there occur patches of volcanic land. On the limestone areas paspalum is the chief pasture grass, and the spring growth is seen mainly in the freshening of the clover plants, whilst on the basalt soils rye-grass is the main pasture constituent and pastures are showing appreciable growth.

The Tara is a low mound of basalt a few hundred acres in extent, which rises as a green oasis in a desert of sterile gum land. Standing on the summit of the Tara one sees to the north the high greywacke hills of the Waipu Fault Block, with Maranui (1,114 ft.) as the chief landmark. To the east lies the Mangawai Estuary, protected by a long coastal sand-dune; and to the west are steep hills of dacitic rocks culminating in the Cattle Mound (1,600 ft.).

The Tara is a very fertile patch of land, and has long been recognized as great fattening country. The pastures are rye-grass and white clover, with a leavening of cocksfoot and paspalum, and are set off with numerous groves of puriri trees with some totara, pohutukawa, and tarairi trees. The land has been in grass for many years and has been maintaining a good pasture sward without much top-dressing: this is the sort of country that does not change hands. Cattle-fattening has been the main industry in the past.

Passed off the edge of the Tara on to the clay hills of the Waitemata beds and the change in pasture sward was immediately noticeable. In place of rye-grass and white clover there was danthonia, brown-top, and paspalum, with patches of subterranean clover and *Lotus hispidus*. Without regular phosphatic top-dressing, pastures of rye-grass and white clover cannot be maintained on these clay hills. One very noticeable thing on going from the good country to the poor country was the condition of the cattle droppings. On really good pasture land—and by good pasture land I mean land that will produce 200 lb. of butterfat per acre—the spreading of droppings during the growing-season does not give any trouble even with the heavy stocking that naturally occurs on such land: the droppings seem to melt and decay very rapidly. But on poor grassland droppings are fibrous and will not decay readily unless broken up and spread with the grass harrows.

The improvement of these poor danthonia, brown-top, and paspalum pastures is not an easy matter. It takes much fertilizer to improve them, and even when manured the production is not as high as it would be if the pastures were renewed and sown down with good rye-grass and white clover. The pastures examined had a fair sprinkling of subterranean clover through them, and improvement, without

renewing, should aim at working the pastures into paspalum and subterranean clover. This combination is quite a good one: subterranean clover produces good autumn, winter, and spring feed, and thus fills up the period when paspalum is more or less dormant.

HOBSON COUNTY.

June 13th, 1934: Dargaville.—In the valley of the Northern Wairoa River are considerable areas of heavy flat alluvial, above which on the east rise rolling hills of claystone, sandstone, and limestone, whilst on the west between the river valley and the sea lie hills of consolidated sand. On the river margin of the eastern hills are patches of volcanic rock—for example, the remarkably sharp and symmetrical cone of Totatoka Peak (660 ft.).

The flat alluvial clay land, generally similar to the heavy alluvial land at Parakai in Waitemata County, is somewhat difficult to handle. Most of it was timbered with white pine and rimu: after the mills had worked over the bush, the land was drained and surface-sown, chiefly with paspalum. On the timbered country cleaning up is now completed on many farms, and pasture improvement has been brought about gradually with the surface-cultivation of existing pastures and the sowing of rye-grass and white clover. Without tile-draining this is probably the best method on really wet land, for if undrained and ploughed it is often difficult to get a good seed-bed.

The sandy hills between the river and the sea show three distinct formations—moving dunes, which are being stabilized with marram-grass planting, young Pleistocene sands which may be developed usefully for farming, and on the east older Pleistocene sands where the surface has been leached and the iron podsol type of soil developed. On the iron podsols hard pans occur through the sand and prevent drainage. This makes the hills wet in winter and dry in the summer. Most of the pastures on this land consist of stunted paspalum and *Lotus hispidus*.

Visited a farm on the flat alluvial clay land. The farm is 120 acres in area, of which some 15 acres are light sandy hill country. The farm milks fifty cows, and the total butterfat-production for the season just ended was 13,000 lb. of fat, the bulk of which was taken off 75 acres of rich flat land that had been ploughed out of the original swamp surface-sown pasture, and resown to perennial rye-grass, paspalum, and white clover. It is not a particularly good farm, for better farms on this heavy land are producing 150 lb. or over of fat per acre. The current low price for butterfat is making dairy-farming difficult on any land that has been bought at a high price and where butterfat-production is below from 140 lb. to 150 lb. per acre.

Paspalum does remarkably well on this heavy alluvial land. It is a grass that requires high soil fertility for maximum production, and on wet undrained land it will withstand flooding conditions for several weeks at a time, and has proved an excellent pioneer in the bringing in of this heavy alluvial land. When the land is drained it combines well with rye-grass and white clover, provided paspalum growth is not allowed to become too rank in the summer. Management then

has a great deal to do with pasture maintenance : the surplus summer growth of paspalum should be cut and saved as hay and silage if rye-grass and white clover are to be maintained in the pasture sward.

Leaving the flat alluvial land, I travelled westwards to Bayly's Beach on the coast. On the westerly hills the iron podsol soils give place to reddish sandy loams which will carry quite fair grass. Most of the original grassing of this country was done by burning the scrub and surface-sowing danthonia, ratstail, and paspalum. Some recent development work has been done here in grassing a block of land for small-farm-plan settlement. Quite good pastures of rye-grass, paspalum, and white clover have been established.

The land dries out rather badly in the summer, but the winter growth is good : where paspalum forms an important part of the sward summer pasture-growth is quite fair. Ploughed, grassed, and top-dressed, much of this scrub land should be very suitable for fat-lamb raising. Without supplies of good certified perennial rye-grass seed the grassing of this country with high-class pastures would have been impossible. The country is watered by lakes which occur in the valleys of streams which have been blocked by drifting sand. I saw some excellent crops of Superlative swedes on this land : they had been sown with a superphosphate-lime mixture, and there is no doubt that on practically all soils this mixture is an excellent fertilizer for both swedes and soft turnips : it gives a good strike, which is one of the main requirements of a good turnip crop.

September 20th, 1934 : Dargaville to Donnellys Crossing.—The Kaihu River Valley, famed for its kauri trees, extends north-west from Dargaville and runs parallel to the west coast : in the south, between the river valley and the sea, lie hills of consolidated sand with swamps in the valleys, but north of Maropiu these hills give place to hills of basalt on which are light dry reddish soils. The river valley is narrow, but contains some excellent flat land that is, however, liable to be flooded in times of heavy rainfall : on these flats paspalum pastures predominate. To the east of the valley are low scrub-covered hills—either consolidated sand or claystone—behind which rise high dolerite hill masses (Angiangi, 1,420 ft.) which are still partially forest-clad.

The soil on the basalt coastal hills is very dry and most of the pastures consist of danthonia, brown-top, and stunted paspalum. White clover does not do particularly well—it may be due to the dryness of the soil, and possibly to the need of lime and phosphates. Visited a farm at Aranga on the basic volcanic land where the pastures were much better than the average of the district—they contained quite a fair amount of rye-grass and white clover. Some newly sown pastures were poor in white clover, but this may have been due to poor consolidation of seed-bed, for no roller was used at sowing-time. The farmer was ploughing old grassland for a crop of soft turnips and swedes : two things would have improved the preparation of the seed-bed—*i.e.*, the use of a skim coulter on the plough and rolling the land on the furrow before disking. A clean seed-bed is essential for a good crop of swedes, and even a small amount of grass growing between the furrow slices reduces the yield. A skim coulter on the plough does not appreciably increase

the draught and makes an excellent job in getting a good clean seed-bed for roots after grass. This light land would also benefit in consolidation from a rolling of the furrow.

Travelled on past Kaihu to the high volcanic country of Whatoro and Tutamoe. This tableland is very wet, and the past development of the bush sections has not been very successful. The land was originally very thickly timbered, and owing to the high rainfall the burns did not clear up the small timber. Most of the pasture land consists of a tight sward of broad-leaved plantain and moss. There is a camp of unemployed men here engaged in logging up the timber on old burns, but it looks as if the patches will have to be completely cleared and ploughed before better pastures can be established.

June 14th, 1934: Dargaville to Tangiteroria.—The road follows the valley of the Northern Wairoa River or crosses low sandstone hills to give a more direct route across the windings of the river. The Wairua Stream, which in the lower part of its course becomes the Wairoa River, has its sources in a central, roughly rectangular basin, the eastern side of which is in places within two or three miles of the east coast. The Hikurangi Swamp lies near the middle of this basin and receives the run-off from the surrounding country by way of streams which flow into it from all points of the compass except the south-west From the Hikurangi Swamp the Wairoa River flows in a deep sluggish stream in a narrow valley, then becoming shallower races over basalt to the Murimanui Waterfall between this waterfall and the Wairua Falls it receives an important tributary from the east the Mangere Stream After joining the Mangakahia River from the north, the Wairoa River flows west through the gap between the Maungaru and Tangihua Ranges—steep volcanic mountains with bush-covered tops and surface-sown pastures on the lower slopes.

The hilly sandstone country, originally bush-clad, has been surface-sown and is used for sheep and cattle grazing Pastures are danthonia on the poorest and driest soils, then, as fertility improves, brown-top, then paspalum, and finally on the best land paspalum, rye-grass, and white clover

Top-dressing has started again on this hill country, and there were some stacks of sacks of superphosphate just delivered by the roadside gates. The top-dressing of hill country requires very careful planning. It should start with the best pastures and be gradually extended to the poorer ones. Increased production from the best pastures means a great deal more than increased production from the poorer pastures—for normally regular top-dressing doubles pasture-production. Top-dressing must be accompanied by increased stocking if the practice is to be payable, and this necessitates that the work must be spread over a number of years.

(To be continued.)

The Fields Instructor, Masterton, advises that pastures systematically top-dressed have provided feed during dry weather better than those untreated.

POTATO-GROWING IN NEW ZEALAND.

II.—DESCRIPTION OF VARIETIES.

R. THOMSON, Assistant in Agronomy, Government Pure-seed Station, Lincoln.

(Continued.)

AUCKLANDER TALL TOP.

Origin.—Selected from a crop of Sutton's Supreme by Mr. A. J. Rich and Mr. Laws, of Kaiapoi, in 1913.

Foliage.—Haulm vigorous, tall, and open ; moderately erect and stiff. Stem, colour 2. Wings slightly waved. Leaf medium dull green ; leaflets small and crinkled.

Flower.—White and fairly numerous ; tall and prominent.

Tubers.—Oval to kidney Skin creamy white, clear, and smooth ; very thin and easily bruised. Flesh white. Eyes medium to shallow. Sprouts pale pink. Large tubers often mis-shaped.

Maturity —Late main crop.

Notes —One of the heaviest cropping varieties, and should be grown where yield alone is the main objective. It is going out of favour on account of its extreme lateness, which results in the skin being immature when dug, and, as a result, bruising exceptionally easily. Certified stocks are available.
The Tall Top may be distinguished from the Short Top by the following characteristics : The Tall Top is taller, the inflorescence is much more prominent, and the flowers more profuse. The Tall Top tubers are not so shapely, and they adhere to the parent plant when the whole shaw is pulled up just before maturity, and when removed tear away, leaving a much larger wound at the point where the stem is attached. When mature the Short Top haulms lie flat and devoid of leaves, in the Tall Top they stand semi-erect and often have attached a number of dead leaves The Tall Top is about three weeks later than the Short Top, while Sutton's Supreme is distinctly earlier than either of the Aucklanders Both varieties are often grown under the name of New Zealand Sutton's Supreme.

BEAUTY OF HEBRON (PINK).

Origin --Raised in America from a seedling of Garnet Chili in 1878, and introduced into commerce by Peter Henderson, of New York.

Foliage --Haulm medium height and vigour, moderately dense and spreading. Stem, colour 1 Wings moderately straight. Leaf medium to dark green ; leaflets fairly large.

Flower.—White and numerous ; tall and prominent, no colour in flower-stalk.

Tubers.—Long, spindle-shaped ; often flattened and notched at heel end. Skin pink and moderately smooth The skin around the eyes of a freshly dug tuber is creamy-white. Eyes moderately deep and evenly distributed. Flesh white Sprouts pink.

Maturity.—Second early

Notes.—Very difficult to distinguish from Early Rose. Of importance only as an impurity of Dakota, from which it can be distinguished by its more prominent inflorescence and the green flower-stalks. Very susceptible to late blight. No pure stocks are available.

BEAUTY OF HEBRON (WHITE).

Origin.—This variety is distinct from the true American White Beauty of Hebron, and probably is identical with White Elephant or Late Beauty of Hebron, in which case it originated as a cross between Garnet Chili and White Peachblow, and was introduced into commerce in America in 1881. See New Zealand White Elephant.

Foliage.—Haulm vigorous, tall, and open. Stem, colour 1 ; branching. Wings waved. Leaf medium to pale green ; leaflets small.

Flower.—White; not very numerous, moderately tall.

Tubers.—Long, spindle-shaped; variable; usually pointed at both ends. Skin creamy white, splashed with variable amount of pink colouring which avoids the eyes. Skin smooth. Eyes medium deep. Flesh white and crisp. Sprouts pink.

Maturity.—Early main crop.

Notes.—A satisfactory garden variety, but too brittle for market. Wildings occur. Great variation in tuber colour, which ranges from almost pure creamy-white to almost all pink.

BLACK KIDNEY.

Origin.—Not known.

Foliage.—Haulm tall and vigorous, open, medium spreading. Stem, colour 3; extends into midrib of leaf; very dark at base and at nodes Wings waved, more especially the lower ones. Leaf grey-green; leaflet soft, slightly wrinkled, dull and hairy; secondaries intermediate.

Flower.—Short and inconspicuous; pale blue-purple with white tips; scanty, buds drop readily.

Tubers.—Long kidney (finger shaped). Skin deep purple; smooth. Eyes medium depth and evenly distributed. Flesh white with occasionally slight purple colour at the eyes Sprouts purple.

Maturity.—First early.

Notes.—An excellent garden variety on account of the very good quality of the tubers. Seldom grown commercially on account of the shape of the tubers. No certified stocks are available.

BRESEE'S PROLIFIC.

Origin.—Probably similar to the American Bresee's Prolific, a seedling of Garnet Chili raised in 1861, and brought into commerce in 1869.

Foliage.—Haulm of medium vigour and height, open and spreading, almost trailing. This habit is very characteristic Stem, colour 0–1; more pronounced at axils of leaves and leaflets; tend to zigzag and bend at the nodes. Leaf small, light to medium green; leaflets widely spaced.

Flower.—White, scanty, flower-stalk short and clusters small.

Tubers.—Flattened oval to kidney, seldom very large. Skin smooth, and of a pale straw colour, turning pale flesh colour on exposure to light; more pronounced on immature tubers. Eyes shallow, mainly at rose end. Skin round eyes pink, and the eye (generally three buds) picked out in deeper colour. Sprouts pink.

Maturity.—Early main crop.

Notes.—A fair variety for light land, but rather susceptible to late blight and internal brown fleck. Large areas of Bresee's Prolific have been grown in the past under the name of Magnum Bonum and Early Puritan. Northern Star is a common impurity, but is easily recognized by its upright habit. Certified seed is available.

FIG. 9. BRESEE'S PROLIFIC

BRITISH QUEEN.

Origin.—Raised by A. Findlay, and introduced into commerce in 1894.

Foliage.—Haulm medium height, vigorous, compact, branching. Stem, colour 2. Wings only very slightly waved. Leaf open and rigid, dark green, glossy; leaflets broad; secondaries small and fairly numerous.

Flower.—Creamy-white, numerous; clusters very large and conspicuous. Flower-stalk bronze-coloured; buds dark.

Tubers.—Oval to blunt kidney. Eyes shallow, with well-developed brow or even shoulder overhanging the eye. Skin white and smooth. Flesh white. Sprouts pink.

Maturity.—Second early.

Notes.—Commonly grown in Great Britain. In trials under local conditions it has given only fair yields even when good seed was available. Not recommended. No certified stocks available now.

BROWNELLS (TASMANIAN).

Origin.—Introduced into Tasmania in 1905 under the name of Adirondack. Under local selection several types have been produced; a parallel to our Aucklander Short Top and Aucklander Tall Top selections.

Foliage.—Haulm tall and vigorous, upright, open, exposing the stem. Stem, colour 2, developed throughout and showing in midrib of leaf and in flower-stalk. Wings waved, especially the lower ones. Leaf medium green, crinkled, secondaries small and numerous.

Flower.—Tall and prominent, red-purple with white tips, large and numerous; persistent.

Tubers.—Round. Skin russet pink. Eyes medium to deep, particularly at rose end deep pink. Flesh white. Sprouts deep pink

Maturity.—Main to late crop, depending on type.

Notes.—The main variety of the Tasmanian export potato trade. It is a good cropper and very good keeper. Unfortunately all the local stocks are badly affected with mosaic, and results have been misleading.

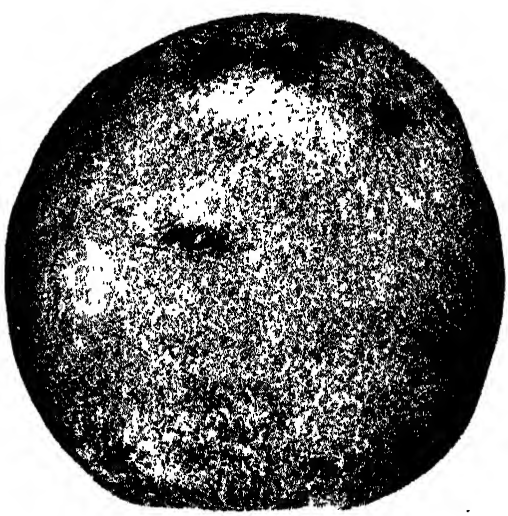

FIG. 10. BROWNELLS (TASMANIAN).

BURBANK.

Origin.—An American variety from an Early Rose seedling. Raised by Luther Burbank in 1871, and introduced into commerce by J. H. Gregory, Massachusetts, several years later.

Foliage.—Haulm medium tall and vigorous, dense, and somewhat spreading. Stem, colour 0–1, branching. Leaf medium green; leaflets long, narrow, tapering to a point.

Flower.—White, moderate bloomer; buds inclined to drop.

Tubers.—Long cylindrical, inclined to be spindle-shaped. Skin creamy-white, smooth. Eyes medium depth and well distributed. Eyebrow distinct. Flesh white. Sprouts pink

Maturity.—Main crop.

Notes.—Has not proved satisfactory on account of the spindly shape of the tubers and the marked tendency to second growth. Russet Burbank, although an improved selection of better quality and producing shorter tubers, cannot be recommended. No certified stocks are available.

CATRIONA.

Origin.—Raised and introduced by A. Findlay in 1920.

Foliage.—Haulm medium height and vigour, compact, spreading. Stem, colour 2. Wings waved. Leaf fairly close, drooping, slightly arched; leaflet medium to dark green, glossy, margins generally waved.

Flower.—Light blue-purple, tipped white; fairly numerous; small; buds dark.

Tubers.—Kidney, long oval, regular. Skin yellow splashed blue-purple in and about the eyes. Eyes shallow. Flesh lemon. Sprouts blue.

Maturity.—Second early.

Notes.—A good garden and show variety, but susceptible to late blight and mosaic. Not recommended for commerce. No certified lines available

CHAS. DOWNING.

Origin.—Not known

Foliage.—Haulm vigorous, medium height, medium dense, semi-spreading Stem, colour 0–1, very slight Wings waved but inconspicuous. Leaf open, flat, medium green: leaflet smooth and fairly dull, secondaries small and few.

Flowers.—Numerous, white, large, medium height. Flower-stalk fairly slender.

Tubers.—Oval to round, flattened. Skin white, smooth Eyes medium depth, mainly towards rose end. Flesh white Sprouts pink.

Maturity.—Second early.

Notes.—Only grown as a garden variety where it does well under good conditions No certified stocks available

FIG. 11. DAKOTA.

DAKOTA.

Origin.—Produced in America in 1883.

Foliage.—Haulm tall, vigorous, moderately open. Stem, colour 3, extending to flower-stalk and leaf-midrib. Leaf medium green; leaflet medium size, drooping; secondaries small.

Flower.—Tall and prominent, white, fairly large, moderately numerous..

Tubers.—Oval flattened, tapering to rose end and deeply notched at heel end. Flesh white and crisp, with sometimes a little colouring near rose end. Eyes very deep and evenly distributed. Skin rough, and red in colour. Sprouts deep pink.

Maturity.—Late main crop.

Notes.—The most valuable red potato, and second only to Aucklander Short Top as the most popular variety grown in this country, on account of its excellent keeping and cooking qualities, and its ability to crop well on the warm light lands of Mid-Canterbury. Leader and Scotia are both serious rogues, but since the introduction of certification have been eliminated from most stocks.

DI-VERNON.

Origin.—Raised by A. Findlay and introduced by him in 1922.

Foliage.—Haulm medium height and vigour, spreading open. Stem, colour 2, mottled, strongly developed in axils of leaves and in flower-stalk. Wings waved. Leaf dark green, glossy, drooping; secondaries small and numerous.

Flower.—Blue-purple tipped white, not numerous; buds dark purple, drop readily; flower-stalk long.

Tubers.—Long oval kidney. Skin yellow, mottled blue-purple, particularly at rose end. Eyes shallow, blue-purple. Flesh lemon. Sprouts purple.

Maturity.—First early.

Notes.—A garden variety, rather susceptible to virus and late blight. Very similar to Catriona, which is taller, more dense, and has lighter coloured buds. No certified stocks are available.

DUKE OF YORK.

Origin.—Raised by W. Sim, Aberdeenshire, and introduced to commerce by Messrs. Daniels in 1891.

Foliage.—Haulm low to medium height, open and straggling. Stem, colour 0, or only trace in lower portion Wings straight. Leaf light yellowish-green, open, drooping; leaflets long, pointed; secondaries fairly numerous.

Flower.—Very rare, white; buds generally drop.

Tubers.—Kidney (pear-shaped). Eyes shallow. Skin yellow. Flesh very yellow. Sprouts pale pink.

Maturity.—First early.

Notes.—A very popular variety in Great Britain, but not likely to become so in this country on account of its very yellow flesh. No certified seed is available.

ENDURANCE.

Origin.—Unknown, probably of American origin.

Foliage.—Haulm fairly tall and vigorous, upright and open. Stem, colour 1. Wings waved. Leaf crinkled, medium-green, fairly open; secondaries small and few

Flower.—White; medium to numerous; flower-stalks medium height.

Tubers.—Large and sometimes irregular, oval to kidney, often flattened at heel end and notched. Skin white; moderately smooth, sometimes flaked. Eyes medium to deep, evenly distributed. Flesh white and crisp. Tubers somewhat similar to those of New Zealand White Elephant, except they are not so coarse and misshapen and show no colour at heel end. Sprouts pink.

Maturity.—Early main crop.

Notes.—A good cropper particularly on light land, but so susceptible to late blight and the tubers are so brittle that it is of practically no commercial importance. No certified stocks are available.

EPICURE.

Origin.—Raised by J. Clark from a cross between Magnum Bonum and Early Regent. Put on the market by Sutton and Son in 1897

Foliage.—Haulm fairly tall, upright, open, and vigorous Stem, colour 2–3 (bronzed, very marked for a white variety) Wings prominent, lower ones waved. Leaf dark green, glossy, drooping; leaflets small, narrow, pointed, last pair generally overlap terminal; secondaries medium numerous.

Flower.—White, rare; buds dark green, drop readily; flower-stalks short.

Tubers.—Round and irregular, deeply notched. Skin white, turning pink on exposure to light. Eyes deep. Eyebrow raised. Flesh white Sprouts pink.

Maturity.—First early.

Notes.—The most important first early in New Zealand on account of its good cropping and general hardiness. Bolters occur frequently and are much taller and later, and flower profusely. On account of their heavier cropping, lines of a bolter type have in some cases replaced the original Epicure where its extreme earliness is not required. Should always be dug as an early, because when left to mature the tubers are very susceptible to brown fleck (rust). Certified seed is available.

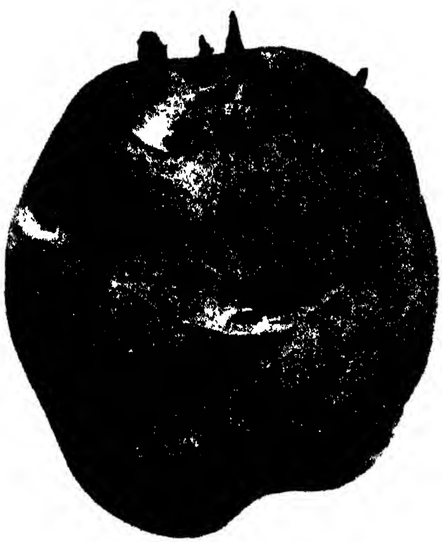

FIG. 12. EPICURE.

ECLIPSE.

Origin.—Raised and introduced by J. Harris, Blackpill Nursery, Swansea.

Foliage.—Haulm of medium height and vigour, open and spreading Stem, colour 3, very well developed towards maturity. Wings slightly waved Leaf light to medium green, fairly open; leaflets small and rounded, secondaries small and few.

Flower.—White, rare, buds dark pink at base, drop readily; flower-stalk short and coloured.

Tubers.—Oval, tendency to broaden at heel end. Skin white. Eyes shallow and mostly at rose end. Flesh white. Sprouts pink.

Maturity.—First early.

Notes.—Has proved only a fair cropper under local conditions, and cannot be recommended for more than garden culture or for exhibition. No certified stocks are available.

EARLY REGENT.

Origin.—Raised by Robert Fenn, Sulhampstead, and introduced by Sutton and Son about 1892.

Foliage.—Haulm spreading, compact, of medium height and vigour. Stem, colour 0–1. Wings slightly waved. Leaf light yellowish-green, terminal leaflet large and broad; secondaries fairly numerous, rounded.

Flower.—White, occasional, large; flower-stalk fairly short.

Tubers.—Oval, notched at heel end, distinctly flat on underside and rounded on the upper. Skin white and smooth. Eyes few and shallow, mainly on the upper surface and towards the rose end. Flesh white. Sprouts pink.

Maturity.—First early.

Notes.—Mainly of importance as a garden variety. Crops are grown in the South for the seed trade of the North Island where the variety is popular in gardens on account of its high quality Not recommended to be grown unless a definite market for the seed is available. Certified lines are available. A high-yielding bolter line has been produced, and certified seed of this also is on the market.

EARLY ROSE.

Origin.—A seedling of Garnet Chili raised in America in 1861, and introduced into commerce in 1867.

Foliage.—Haulm of medium height and vigour, fairly dense and spreading. Stem, colour 1–2 (more than on Beauty of Hebron). Wings moderately waved. Leaf medium to dark green; open, colour at base of leaflet-stalks; leaflets fairly large and pointed; secondaries few and small.

Flower.—White, moderately numerous (very prolific in bolter type); flower-stalk long.

Tubers.—Long oval-pointed, often notched at heel end. Skin even pink all over, fairly smooth. Eyes medium deep. Eyebrow distinct. Flesh white with streaks of pink Sprouts deep pink. (There is no variation in colour around the eyes as can be observed in a freshly dug Beauty of Hebron, and the sprouts are also deeper pink than that variety.)

Maturity.—Second early.

Notes.—This variety has played an important part in the history of potato improvement, and is regarded as the fountain-head of many present-day varieties. It is in demand for gardens, but is not of commercial importance on account of its brittleness and poor keeping-quality. Certified seed is available. A very coarse, long-tubered bolter is produced

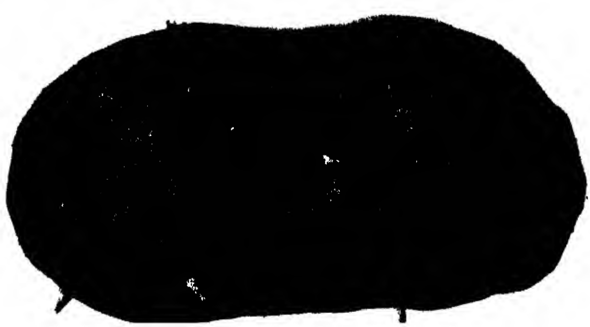

FIG. 13. EARLY ROSE.

EARLY PURITAN.

Origin.—Said to be a seedling of Beauty of Hebron, and introduced into commerce in America in 1888. It is synonymous with the true American White Beauty of Hebron, but not with the New Zealand White Beauty of Hebron.

Foliage.—Haulm of medium height and vigour, spreading and medium dense. Stem, colour 1. Wings slightly waved. Leaf medium green and glossy; secondaries very small.

Flower.—White, fairly numerous; flower-stalk long.

Tubers.—Oval, pointed, often flat at heel end. Skin white and smooth. Eyes medium deep. Eyebrow long and distinct. Flesh white. Sprouts pink.

Maturity.—First early.

Notes.—A good cropper for a first early, but too susceptible to disease, particularly late blight, to be of commercial importance. No certified stocks are available, and indeed it would be difficult to find pure crops, despite the fact that a good deal of seed is sold under the name of Early Puritan.

FIELD MARSHAL.

This variety is identical with Up-to-Date except that the tubers have a russet skin.

FIG. 14. FIELD MARSHAL

GREEN MOUNTAIN.

Origin.—An American variety.

Foliage.—Haulm tall and vigorous, fairly erect. Stem much branched, colour 1. Wings prominent, straight. Leaves large, medium green, leaflets broad, slightly drooping.

Flower.—White, numerous; flower-stalk fairly long.

Tubers.—Oval, flattened, with blunt ends. Skin dull white, sometimes slightly netted. Eyes fairly shallow, mostly at rose end. Flesh white. Sprouts pink.

Maturity.—Main crop.

Notes.—Has been tried under local conditions but proved too susceptible to late-blight infection to be of commercial importance. It is also susceptible to mosaic. No certified stocks are available.

GOLDEN WONDER.

Origin.—Raised by J. Clark, Christchurch, England, from a seed-ball of Early Rose. Introduced to commerce by Brown, Peashell Farm, Arbroath, in 1906. Langworthy is identical except that it has a white skin.

Foliage.—Haulm tall, vigorous, open and very upright. Stem, colour 0–1. Wings not constant. Leaf medium to dark green, open; leaflets wrinkled (mosaic often present); secondaries small and few.

Flower.—Purple with white tips, fairly numerous; fall early; flower-stalk long.

Tubers.—Kidney (pear-shaped). Skin thick russet brown. Eyes shallow, mainly at rose end. Flesh white to pale lemon. Sprouts blue.

Maturity. Late main crop.

Notes.—A splendid-quality potato and excellent keeper, but not likely to become of commercial importance on account of producing a large proportion of small tubers, and on account of its dirty brown appearance. Very susceptible to mosaic. No certified lines are available.

GOLD COIN.

Origin.—An American variety introduced into commerce about 1903.

Foliage.—Haulm of medium height and vigour, spreading and open. Stem, colour 0–1. Leaf light green ; leaflets small.

Flowers.—White, rare ; buds green, drop off readily ; flower-stalk short, green.

Tubers.—Large, long oval, flattened Skin light creamy brown ; smooth to rough. Eyes moderately deep Flesh white. Sprouts pale pink.

Maturity—Main crop.

Notes—A good cropper on good land, but too susceptible to late blight to be of commercial importance. No certified seed is available

GREAT SCOT.

Origin—Raised by G. Mair, of Lockerbie, in 1906, and introduced to commerce by A W McAlister, Dumfries, in 1909. Sefton Wonder is identical with Great Scot, except that the skin of the tuber is russet

Foliage-Haulm tall, upright, open and vigorous. Stem, colour 1. Wings straight. Leaf dark green and glossy, drooping at tip, leaflets medium size ; secondaries fairly well developed

Flowers—White, rare, buds generally drop off, flower-stalks very short.

Tubers Round, often dented at heel end Skin yellowish white, rough. Eyes medium, but deep at rose end. Flesh white Sprouts pink.

Maturity.—Second early to early main crop

Notes-A variety that deserves to be grown more than it is at present A good cropper considering its earliness Not susceptible to late blight, and a good keeper On light land a somewhat high proportion of small tubers is produced, and on heavy land the large tubers are subject to hollow-heart. Certified seed is available

FIG. 15. GREAT SCOT.

HERALD.

Origin.—Raised by Messrs. McGill and Smith, Ayr, and introduced by them in 1927.

Foliage.—Haulm of medium height and vigour, open, becomes spreading at maturity. Stem, colour 1. Wings straight Stem branched. Leaf medium green, long, and drooping; leaflets fairly large and pointed, glossy, terminal leaflets often tied; secondaries fairly large, few.

Flower.—White, small, rare; flower-stalks long

Tubers—Oval. Skin white Eyes shallow. Flesh white Sprouts purple

Maturity—Early second crop.

Notes—Although attractive in shape it crops poorly for its maturity and is not recommended No certified stocks available

INCOMER.

Origin.—Raised and introduced by C. Brown, Pitnappie, Newtyle

Foliage—Haulm tall, upright, vigorous, and compact Stem branched, colour 2 Wings mostly straight Leaf close; leaflets dark grey-green, dull, long, broad, cupped; secondaries numerous and pointed

Flower.—White, not numerous, buds pink, drop readily; flower-stalk short.

Tubers.—Short, oval Skin white Eyes shallow. Eyebrow indistinct Flesh white. Sprouts pink

Maturity—Late main crop

Notes—Has been tried locally, but produced too many small tubers to be of commercial importance No certified stocks available

IRISH COBBLER.

Origin—Said to be a sport from Early Rose in 1876 in United States of America Known in Great Britain under the name of America

Foliage—Haulm of medium height and vigour, semi-erect Stem, colour 2. Wings waved. Leaf slightly arched, fairly close, leaflets medium green, large, rounded, secondaries fairly large and numerous

Flower—Light reddish-purple with white tips, large, fairly numerous, flower-stalks long

Tubers—Round, heel end often depressed Skin white Eyes fairly deep. Eyebrow fairly long and distinct Flesh white Sprouts pink

Maturity—First early

Notes—Too susceptible to mosaic to be of commercial importance in this country, although a very popular variety in America No certified stocks available.

IRON DUKE (PRESIDENT).

Origin.—Raised and introduced by G Veenhuizen, Sappemeer, Holland, in 1896, and known in Holland as Paul Kruger The variety General is identical with President except that its flowers are white

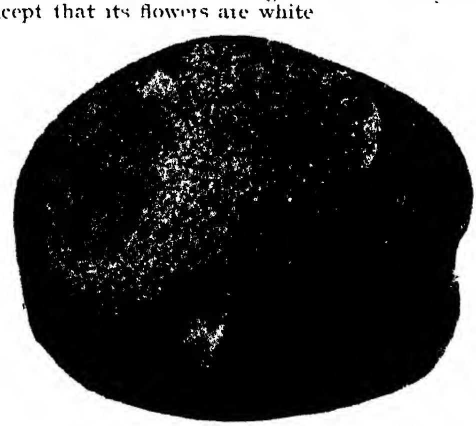

FIG. 16. IRON DUKE (PRESIDENT).

Foliage.—Haulm tall, upright, open, and vigorous. Stem branched, colour 1. Wings waved. Leaf open, erect, and rigid, leaflets large, broad, distinct light to medium green colour; secondaries small.

Flower—Red-purple distinctly tipped white, numerous and persistent; flower-stalks long.

Tubers.—Round to oval, slightly flattened. Skin white and rough. Eyes medium. When mature the skin around the eyes sometimes shows a pink tinge. Eyebrow distinct. Flesh white Sprouts pink.

Maturity—Late main crop.

Notes.—A heavy cropping variety, which can be recommended for rich land. A good keeper and fairly resistant to late blight. Generally infected with mosaic, but very tolerant to that disease; degeneration is very rapid when infected with leaf-roll Certified stocks are available.

(To be continued.)

STAGGERS IN LIVE-STOCK.*

C. S M HOPKIRK, Veterinary Laboratory, Department of Agriculture, Wallaceville.

THE term "Staggers" is much used by New Zealand farmers to describe a variety of diseases in horses, sheep, and cattle. It should be remembered, however, that a staggering gait or inco-ordination of movement is a symptom of many diseased conditions. Discrimination is shown by the farmer when the term is applied to grass-staggers of dairy cows, rye-grass and paspalum staggers of stock, and to a less extent in stomach staggers of horses. Such conditions as bloat and milk-fever of dairy cows, ante-partum paralysis and circling disease of sheep, arthritis in lambs, all produce some inco-ordination of movement in an affected animal as does tuberculosis of the brain, but not in such a way as to warrant the term "staggers."

Only the first four conditions mentioned are considered herein.

STOMACH STAGGERS OF HORSES.

Brief reference to stomach staggers of horses suffices, for one rarely sees it. When it does appear it means that the horse is seriously ill with acute inflammation of the stomach. In such cases it is advisable to get veterinary help as soon as possible.

RYE-GRASS STAGGERS.

Rye-grass staggers affects sheep, cattle, and horses, together with the young of those species. Nothing is more alarming to an owner, on going out one morning, than to find a large number of sheep taking what appear to be fits as soon as they commence to move. Rye-grass staggers is seen usually after a dry autumn on paddocks in which rye-grass is predominant. Usually rain has fallen a few days previously, so that probably there is a short quick growth just commencing. Up till then the paddock has been dry and bare. The symptoms in the milder cases, usually in horses and cattle, are an inability to move rapidly, the legs being stiff; a board-like motion of the whole body in turning, a swaying movement of the hindquarters, a tendency to fall with recovery only by an effort, staring eyes, and laboured breathing. When

* Portion of lecturette broadcast from Station 2YA.

the animals are not disturbed no symptoms are noticeable, grazing takes place quite naturally, yet there is a disinclination to lie down. If the affected animals are startled the legs move spasmodically, and great difficulty is experienced in placing the feet where required. Occasionally horses and cattle fall and find difficulty in regaining their feet. Sheep usually are affected acutely. When the dog is sent round almost the whole flock will start running, then prance shortly with head held high. The body sways, the eyes roll, and the sheep then falls over unconscious, legs straightened, head back, eyes twitching and rolled back, and body trembling. After a few seconds relaxation occurs and consciousness returns, the sheep regains its feet and runs a few more yards before repeating the performance. Death rarely occurs and post-mortem analyses of organs and blood and sections of brain, liver, &c., prepared for the microscope do not show any recognizable change.

For some years rye-grass staggers has been associated with ergot, which is seen as a long black banana-shaped fungus in its sclerotia stage on the seed-heads of rye-grass, cocksfoot, and tall fescue. Certainly ergot will cause a dry necrosis of the lower part of the leg well known to many ; but it also is known to act on nerves at times, particularly when there is any shortage of vitamin A, as occurs in the dry pasture in the late autumn The actual stage in which this species of ergot is harmful to the nervous system is not yet known, but from circumstantial evidence one would suspect that the honey-dew stage, the stage of sporulation, is responsible. As the grass is not seeding but is particularly short when staggers occurs, many hold that ergot cannot be held responsible, but it is usual to find ergot in considerable quantity lying on the ground in paddocks where staggers occurs in the stock.

Rye-grass ergot fed experimentally in the sclerotia stage to sheep at Wallaceville did not produce anything but ulceration of the stomach and tongue of the sheep.

The feed of animals affected with rye-grass staggers should be changed —for example, a change to danthonia from rye-grass is quite efficaceous. Within a week nothing abnormal can be seen Where it is impossible to change paddocks, hay should be fed, and, where conditions allow, Epsom salts may be placed in the drinking-trough at the rate of 20 lb. to 100 gallons of water. Valuable horses can be given stimulant-powders, but that method of treatment is too expensive for cattle and sheep. Animals left entirely alone will recover slowly, but there is the danger of their being caught up in fences, drowned in drains, &c. Dogs should be used as little as possible throughout an attack of this disorder.

Paspalum Staggers.

Paspalum staggers is very similar to rye-grass staggers In New Zealand the condition is rare, and was seen this autumn for the first time. It is common in South Africa, however, and parts of the United States of America where the paspalum is infested with a species of ergot. In our explanation of the paspalum pasture in the Waikato and North Auckland ergot was found in large amounts, but the plants were also badly infested with another fungus — a species of *Fusarium*, which American workers say affects paspalum flowering-heads only when the spores of ergot are present. Paspalum staggers mainly affects cattle, but may be seen in horses and occasionally in sheep. One owner

said, "My cows are all drunk, what shall I do with them?" That remark is a satisfactory summing-up of the appearance of the trouble. Cattle have a swaying gait, find difficulty in walking, tremble excessively, and have staring eyes. Breathing is laboured, and some animals salivate freely. Rarely they fall, in which case the legs are frequently stretched out behind them. They have difficulty in rising.

At the time of the investigation the paspalum had been eaten down, but was quite green and had come away with great rapidity following warm rain. Seed-heads had grown to maturity in from two to three weeks. The leaves of the plants appeared free from blight. Cattle were eating the heads. One owner had thirty cows affected on the first morning, fifty the second, and seventy-eight the third, and had great difficulty in getting them to the shed for milking. The supply of milk was not badly affected, for if left quiet the animals chew the cud and behave normally, but move round stiffly. They are, however, very easily frightened. In about five days from the time of first seeing the nervous symptoms the animals appear almost normal, though, if driven, they get very excitable, as evidenced by a mob of fat bullocks driven to the meat-works a fortnight after the attack.

The best method of treatment is to remove the stock from paspalum if possible. If not, they should be put in the barest paddock, and fed hay so that they will eat less of the grass. They quickly recover. Symptoms are more alarming than dangerous Nothing abnormal is to be seen in post-mortem examination of the cattle affected - many were closely examined in the meat-works.

The ergot of paspalum is a brown berry-like excrescence of 2 mm. to 4 mm. in diameter, attached to the seed-heads, often in considerable numbers. As with rye-grass ergot the fungus falls to the ground and when opportunity occurs forms spores. The paspalum seed-head is not kept in check by stock to the same extent as that of rye-grass, and therefore stock could the more easily eat quantities of the growing ergot. Stock, however, do not eat paspalum seed-heads unless they are hungry following droving, or unless the pasture tends to get somewhat short. That the paspalum ergot in the brown sclerotia stage is capable of producing staggers was tested out in Mississippi, United States of America, and in South Africa: 8 lb of seed-heads will cause acute staggers. Further, twenty-four ergot bodies fed to guinea-pigs daily for a week kills the guinea-pigs, while fifty bodies fed on one day causes nervous symptoms.

Paspalum seed-heads gathered at North Auckland are now being fed to experimental rats in the Wallaceville Laboratory to find just how toxic the material is.

GRASS STAGGERS.

Grass staggers is a disease of dairy cows in which the cow becomes affected from two to six weeks after calving, and in which there is a very high death rate. The name grass staggers is a poor one, and others such as grass tetany, eclampsia, &c., have been used. It is only within recent years that much has been known of this serious condition. Usually many cases are to be seen in August and September in the Waikato and the Bay of Plenty. Sometimes cases occur in the Gisborne, Manawatu, and Wairarapa districts. Taranaki is as yet free, though it may not remain so always. There seems to be a reason why certain districts are more frequently affected than others. Usually they are

rich areas heavily top-dressed with superphosphate and inclined to be deficient in lime and in magnesium. Milk-fever is usually prevalent on the same farms as is grass staggers, or in districts affected with grass staggers.

The symptoms of the disease vary from mild to acute. In mild cases cows walk stiffly or stand about twitching or trembling slightly, and are easily frightened. Such cases may, when being driven to the yard or during milking, drop down in a fit, and may even die at that stage. The stage is acute when the cow is found in convulsions and unconscious, eye turned back and twitching, and often showing paddling movements of the limbs. To get such cows conscious and on their feet has been very difficult in the past, but with an increase in our knowledge results of treatment during the past two years have been better. The blood of such cows is very deficient in magnesium and to some extent in calcium There is an antagonistic action between calcium and magnesium in the blood in their action on nerves. Calcium irritates nerves and magnesium has a soothing affect on them. With too little magnesium the calcium has had the upper hand, and the cow becomes irritable, nervous, and highly strung, sufficiently so at times to charge the owner without much provocation. When the magnesium is replaced the cow once more regains its placidity.

Treatment then consists in replacing the magnesium. This can be done by drenching with Epsom salts—*i.e.*, sulphate of magnesia—if the cow be lightly affected There is, however, always the danger of the cow taking convulsions during the act of drenching. It is better in mild cases for the cows to drink water from a water-trough which is kept medicated with Epsom salts, say 1 lb. to 20 gallons water. Should the cow be affected acutely it requires injection of Epsom salts under the skin, and this should be done by a veterinarian, who can gauge the amount the animal may take without causing death.

Prevention, however, is by far the best course to adopt. Many farmers know when to expect trouble, usually after the hay and silage are finished, and when the spring flush of grass appears. Actually the whole of the year's growth of pasture has been slightly deficient in magnesium and lime, but this is accentuated to a dangerous degree, one thinks, by the high phosphate-content of the young grass in the spring. Experimental trials have been made with both the sulphate of magnesia and with a mineral known as dolomite, which contains much magnesium, and both have been found helpful. As soon as cases are noticed on the farm it is wise to add Epsom salts to the water-troughs, keeping the ball-cock tied up—½ per cent. solution is tasteless and if kept constantly before the cows wards off the trouble. Where water-troughs are not available Epsom salts can be spread on silage or dampened hay for the cows during the latter part of the winter. Ground dolomite has been used also as a lick and spread on silage or hay. On two farms a trial is being made with dolomite sprinkled throughout the silage while it was being stacked, so that magnesium is incorporated from the start, and cows must get it during the winter to store for the after-calving period.

Considerable experimental work on assimilation of magnesium by stock has been and still is being carried out at Wallaceville, and an all-the-year-round analysis of grass is being made from certain farms in the Waikato, where the disease is prevalent.

PREVENTION OF MOULD-GROWTH ON BOX-TIMBER.

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WOODEN cases used for the package of various commodities such as butter, soap, canned goods, &c., when exposed to damp conditions frequently become disfigured by mould-growth. From the cases the mould is apt to spread to the contents, causing discoloration and spoilage of bulk-packed commodities such as butter or of the container or label of packeted goods. The experiments detailed in this article were designed to find a practicable method whereby such case-wood might be treated to render it permanently unsuitable for mould-growth.

Previous work on the control of moulds on timber* had failed to find a substance that would efficiently control moulds and be suitable for use in connection with foodstuffs In discussing the matter with the research chemists of the Imperial Chemical Industries, Ltd., at Manchester, it was suggested that one or other of the salicylanilide products might be suitable for the purpose. The water-soluble sodium salt of salicylanilide, sold under the trade name "Shirlan, W. S.," appeared to be the most promising, and it was with supplies of this material, kindly provided by the above company, that the following experiments were carried out

Shirlan W. S. is a white powder completely soluble in cold water, making a solution, at the dilutions used, that is colourless, odourless, and tasteless It should also be completely harmless in the quantities likely to gain access to contained foodstuffs from treated case-timber.

EXPERIMENTAL METHOD.

Blocks of $\frac{1}{4}$ in. white-pine (*Podocarpus dacrydioides*), butter-box timber 2 in. square, treated and untreated, were inoculated by dusting with spores of the commoner box mould fungi (*Cladosporium herbarum*, *Alternaria* sp., *Penicillium expansum*, *P. puberulum*), (and with pieces of culture of *Pullularia pullulans*), placed on filter paper germinator pads in petri dishes, 10 c.c. of water being added to each dish, and incubated for from five to fourteen days at 22° C. Preliminary experiments showed that, while a treatment by immersion for ten minutes or more in a solution of 0·1 per cent. Shirlan W. S. prevented the growth of all the moulds enumerated, the results of inoculations on the untreated blocks varied with different blocks even when cut from the same board. Good growth took place on those blocks of peripheral sap wood which contained available nutriment for the moulds, but little or none on pieces cut from more central portions of the tree. To overcome this difficulty it was found that, by boiling the blocks for one hour in Czapek nutrient solution followed by thorough drying, it was possible to ensure

* NEILL, J C., The Control of Mould Fungi in Dairy Factories and Meatworks, *N.Z. Journ. Agric.*, Vol. 48, pp. 70–75; 1934.

maximum growth on all blocks irrespective of their nature. In the following experiments all the material was so treated, and inoculations were made with *Cladosporium herbarum* (Black-spot mould), since this mould appeared to be the most resistant to treatment, is readily seen with the naked eye, and is the commonest mould to develop on case-timber.

Experiment 1.

To determine Minimum Time and Concentration of Steep.—Wood blocks were immersed for periods of two seconds, one minute, four minutes, six minutes, and ten minutes in solutions of Shirlan W. S. at 0·01, 0·025, 0·05, 0·075, and 0·1 per cent. at 58° F., dried, inoculated, and incubated. Examination in seven days showed profuse growth on the untreated control blocks, and an amount varying inversely with time and concentration of dip on the treated blocks. Since the maximum time and concentration of ten minutes at 0·1 per cent. still permitted some growth of the mould, these figures were taken as the minimum for further experiments

Experiment 2.

To determine Effect of Temperature of Steep.—Wood blocks were immersed for ten minutes at 0·1 per cent Shirlan W. S. held at 58°, 100°, 120°, 140°, 160°, 180°, 210° F., dried, inoculated, and incubated. Examination in seven days showed no differences in growth of the mould up to 160°. At 180° and 210° growth was rather more marked.

It appeared, therefore, that no useful purpose would be attained by raising the temperature of the steep.

Experiment 3.

To determine the Optimum Minimum Time and Concentration of Steep.—Wood blocks were immersed for ten, thirty, and sixty minutes in solutions of Shirlan W. S. at concentrations of 0·1, 0·25, 0·5, 0·75, and 1 per cent., dried, inoculated, and incubated. Two blocks were used for each treatment, and the untreated control blocks were soaked in water for corresponding times, dried, inoculated, and incubated. The results of examination in five days are given in the following table:—

Treatment	Time of Immersion					
	10 Minutes		30 Minutes		60 Minutes	
	A.	B.	A.	B.	A.	B.
Shirlan W. S. 0·1 per cent. ..	x	x	x	x	x	x
Shirlan W. S. 0·25 per cent. ..	x	x	o	x	o	o
Shirlan W. S. 0·5 per cent. ..	x	o	x	o	o	o
Shirlan W. S. 0·75 per cent. ..	o	o	o	o	o	o
Shirlan W. S. 1 per cent. ..	o	o	o	o	o	o
Water only	x	x	x	x	x	x
Control (not steeped) ..	x	x				

x Indicates some mould-growth.

On re-examination after a further incubation period of ten days *Cladosporium* colonies had developed on all blocks, their relative extent being best shown in the accompanying photograph of one block from each series.

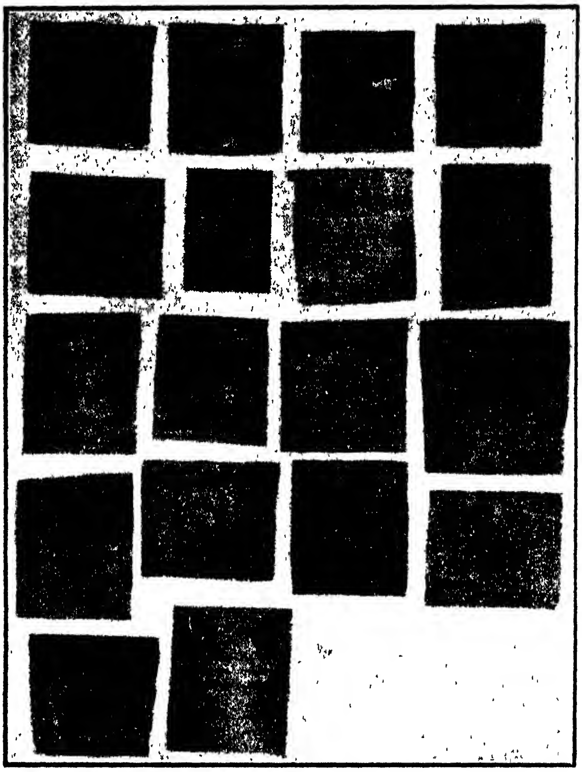


FIG. 1.

It will be seen that, compared with the three untreated blocks marked W/10, W/30, and W/60, the development of mould on the series at 0·1 per cent. and on the 10-minutes steep at 0·25 per cent. was relatively small, while on the rest of the series it was practically negligible.

EXPERIMENT 4.

Practical Test on the Control of Mould on Butter-boxes.—This experiment was conducted in conjunction with the Dairy Research Institute in connection with an investigation on the relative qualities of various types of butter-boxes. Full details of this investigation are embodied in a special report, therefore only a graphical summary of the results in so far as they affect the control of mould by Shirlan W. S. will be given here. Sixty-five half-hundredweight export butter-cases were used in the experiment. Those treated with Shirlan W. S. were kept immersed, before making up, in a 0·1-per-cent. solution at about 56° F. for ten minutes. They were then air-dried for four days, made up, and those to be inoculated sprayed on the inner surfaces with a water suspension of *Cladosporium*

herbarum, spores and mycelia, grown on wood. The boxes were then lined with parchment, packed with butter, and closed in the normal way. After packing, the boxes of butter were stored for seven days at 14° F., then removed to a room held at temperatures from 70° to 80° F. with minimum ventilation and maximum humidity for ten days. Before stacking in this room the boxes were repeatedly dropped from a height of 3 ft. to simulate damage in handling. This resulted in many of them being "sprung" at the corners with openings which admitted air freely to the inner surfaces with consequent heavy condensation of moisture. The boxes were then opened and examined. The moulds present included species of *Cladosporium*, *Penicillium*, *Fusarium*, *Alternaria*, and *Mucor*.

A graphical summary of the results is provided in the appended table, in which the number of crosses indicates relative severity of mould infection :—

Type of Box.	Not inoculated.		Inoculated.	
	Untreated.	Treated.	Untreated.	Treated.
A	x	o	xx	x
B	xx	o	xx	x
C	xx	o	xxx	x
D	xxxxx	x	xxxxx	x
E	x	o	xx	x
F	o	o	x	o

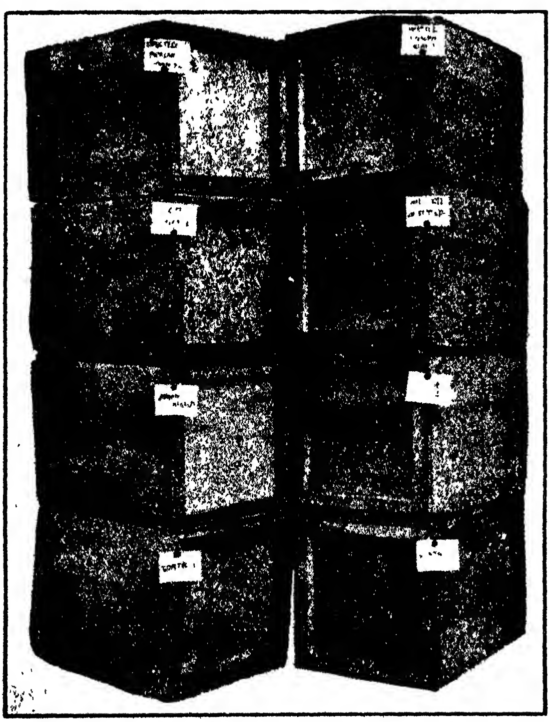


FIG. 2. SPECIMENS OF D AND E TYPES OF BOXES AT EXAMINATION.

These results indicate that the treatment renders butter-box timber extremely resistant to mould-growth.

Summary of Experimental Results.

(1) The degree of mould-growth on blocks of white-pine timber varied widely even on blocks cut from the same board.

(2) Consistent maximum growth on all blocks was obtained by a preliminary impregnation with Czapek nutrient solution.

(3) Steeping such blocks in sodium salicylanilide, followed by drying, rendered them resistant to subsequent mould-growth.

(4) The degree of resistance obtained varied directly with both concentration and time of immersion.

(5) Increase of steep temperature did not render the treatment more efficacious.

(6) Complete immunity from mould colony formation was not obtained at times and concentrations up to sixty minutes at 1 per cent. Shirlan W. S.

(7) A degree of resistance sufficient for most practical purposes was obtained by immersion for ten minutes in a 0·1-per-cent. solution of Shirlan W. S.

APHIDES AFFECTING CULTIVATED PLANTS.

(4) APHIDES OF THE PEACH, PLUM, AND APPLE.

W. Cottier, Entomology Section, Plant Research Station, Palmerston North.

Aphides in the orchard are often of very great economic importance—*e.g.*, the green and black aphides of the peach and the black aphis of the plum. Any one of these can at times cause great damage. The spring is usually the period at which most damage is done, the succulent developing foliage on stone fruits frequently being severely stunted and curled, the insects thickly encrusting the young growth.

On the peach in New Zealand there commonly occur three aphides, one, the green aphis, *Myzus persicae*, and the others the brown or black aphides, *Anuraphis schwartzi* and *A. persicae-niger.* On the plum occurs the black aphis, *Rhopalosiphum nymphaeae*, while on the apple the two most characteristic are the woolly aphis, *Eriosoma lanigerum,* and the green aphis, *Aphis pomi.*

For the convenience of those who might wish to distinguish between the various species, the two common forms of each aphis are described below in language as simple as possible. Both these forms are viviparous—*i.e.*, producing living young—one form is winged and the other is without wings. Those who might require details of the terms used in the descriptions will find them in No. 2 of this series in this *Journal* for May, 1935.

Aphides of the Peach.

The Green Aphis (Myzus persicae).

The wingless viviparous female of this species is most commonly a whitish-green to dark green, but it also may be shades of pink. This wingless form is usually 1·5 mm. to 2 mm. long and presents a

somewhat flat appearance. The antennæ are slightly shorter than the body, the frontal tubercles project inwards, and the cornicles are usually slightly swollen at or near the middle.

The winged viviparous female has four wings, the front pair being much larger than the hind pair. The head and thorax are black, while the upper surface of the abdomen is greenish with black bands and has a large black patch in the centre. The cornicles are usually very dark and are swollen at or near the middle. The antennæ are approximately as long as the body. Length of the insect is 1·5 mm. to 2 mm.

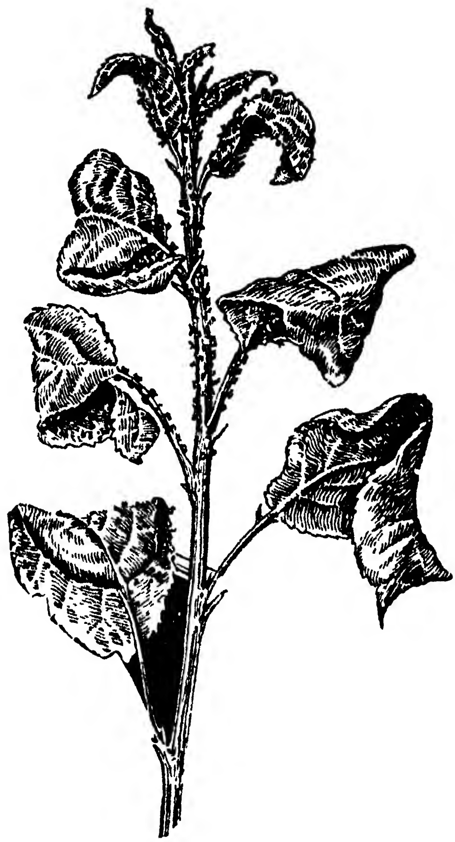


FIG. 1. TYPICAL APHIS INFESTATION ON YOUNG GROWTH.
[*From Quaintance and Baker, U S D.A.*

HOST-PLANTS IN NEW ZEALAND.

M. persicae has been taken from the following plants: Potato, tomato, *Brassica* spp., peach, beet, garden peas (*Pisum sativum*), docks (*Rumex* spp.), fat-hen (*Chenopodium album*), nightshade (*Solanum nigrum*), *Hebe* sp., Californian thistle (*Cirsium arvense*), *Daphne* sp., *Lilium* sp., *Chrysanthemum*, *Cineraria*, pansy, chickweed (*Cerastium vulgatum*), and tobacco.

OBSERVATIONS.

In the southern portions of New Zealand this aphis passes the winter in the egg-stage on the peach-tree. In the late autumn sexual forms appear, the winged male and the wingless female, this being the only occasion on which the male appears in the life-cycle. The female lays eggs on the wood at the bases of the buds, these eggs at first being light in colour, but they soon change to shining black. The eggs hatch in the spring, when the buds burst and there is succulent green foliage upon which to feed. However, in the warmer climates this aphis can pass the winter in the summer form on any suitable plants that happen to be in leaf at that time of the year. *Brassica* spp. are favourite food-plants in the winter, and the green aphis can be found on these hosts all the year round. Thus it is possible that in the spring a peach-tree or orchard can be infested from neighbouring *Brassica* spp. or other hosts.

The Black Peach Aphis (Anuraphis schwartzi).

The wingless viviparous female of this species is really very dark brown and is approximately 1·5 mm. long. The antennæ are shorter than the body, which is globular and shining.

The winged viviparous female is almost the same colour as the wingless form and is approximately the same length. The antennæ are about as long as the body.

HOST-PLANTS IN NEW ZEALAND.

Peach and nectarine.

OBSERVATIONS.

In Palmerston North the writer has found the shining black eggs of this aphis laid at the bases of the buds on peach-wood in winter. The life-cycle is similar to that of the green aphis, the eggs hatching in the spring to infest the young green foliage. As a pest *A. schwartzi* does not appear to be as notorious in this country as does the green aphis, but it has been reported as causing severe damage by curling the developing leaves.

The Black Peach Aphis (Anuraphis persicæ-niger).

This aphis is often called by English writers the " Black Peach Aphis of America." To the ordinary observer there is no apparent distinction between this species and the preceding one. Separation of these two species requires a microscopic examination.

HOST IN NEW ZEALAND.

Peach.

OBSERVATIONS.

The damage caused by this aphis is again not usually comparable with that caused by the green aphis.

It is reported that this species migrates to the roots of the peach to pass the winter. As soon as the buds burst in the spring aphides migrate from the roots to the aerial parts of the tree and pass the summer there. With the approach of winter they return to the roots.

The Aphides of the Plum.

THE BLACK APHIS (RHOPALOSIPHUM NYMPHAEÆ).

The wingless viviparous female is approximately 2·5 mm. long. It is very dark green to almost black in colour, with the antennæ shorter than the body, which is globular.

The winged viviparous female is much the same colour as the wingless form. The insect is approximately 2 mm. to 2·5 mm. long, with the antennæ shorter than the body.

HOSTS IN NEW ZEALAND.

The known hosts are plum and apricot.

FIG. 2. APHIS ON PLUM.

[From U.S D.A Farmers' Bull. 908.

OBSERVATIONS.

*No details of the life-history of this aphis in New Zealand are available. In other countries the insect passes the winter in the egg-stage on the plum, the spring foliage of which is often severely damaged by the hatching aphides. In the summer the aphides leave the plum and migrate to various water-plants, such as water-lilies and various water-weeds. In the autumn they return to the plum to lay their eggs. In New Zealand this aphis is often the cause of severe damage to plums in the spring, the young shoots being heavily laden with the lice.

Apple Aphides.

WOOLLY APHIS (ERIOSOMA LANIGERUM).

Most growers are familiar with this pest, and it has not been thought necessary for the purposes of this article to describe it.

HOSTS IN NEW ZEALAND.

Apple.

* **Recently (July) the writer observed the eggs of an aphis, most probably *Rhopalosiphum nymphaeae*, at the bases of the buds of twigs of plums.**

OBSERVATIONS.

This species causes swellings on the wood of infested trees. Before the introduction of the parasite *Aphelinus mali* this aphis was a serious pest in the orchard, but the success of *A. mali* in New Zealand has been so great that orchardists no longer fear this insect.

THE GREEN-APPLE APHIS (APHIS POMI).

The wingless viviparous female is green, with the cornicles black. The antennæ are not quite as long as the body. The insect is 1·5 mm. to 2 mm. long.

FIG. 3. APHIS-EGGS ON TWIG (MUCH ENLARGED).
[From N.Y. Agr. Exp. Sta. Memoir 24.

The winged viviparous female has the head and thorax black, while the abdomen is green. The antennæ are shorter than the body. Length of insect approximately 1·5 mm.

HOSTS IN NEW ZEALAND.

Known hosts are apple and pear.

OBSERVATIONS.

This aphis is very common on apple and pear, and seems to attack particularly the young shoots of pear, on which it can cause severe damage. On apples, however, this aphis does not seem to be of much

importance. The life-history in New Zealand has not been followed. In other countries, however, eggs are laid in the autumn to carry the insect over the winter, the whole life-cycle being passed on the apple or pear.

CONTROL MEASURES.

There are two methods of spraying for control of aphides on fruit-trees. One is by applying a tar-distillate spray in the dormant season to kill the over-wintering eggs, and the other is to spray with a contact insecticide, such as nicotine sulphate plus soap, in the growing season. The most recent development in the control of the green aphis on peach is to spray with tar-distillate washes in the dormant winter period. In the southern districts of the South Island where this aphis is known to over-winter on the peach-trees in the egg-stage this method is to be recommended. The tar-distillate is applied at the rate of 1 part to 30 parts of water in the truly dormant period before any buds are moving. The tar-distillate spray can also be used as a winter wash against the eggs of the black peach aphis, *Anuraphis schwartzi*. In districts where the black plum aphis, *Rhopalosiphum nymphaeae*, is troublesome in the spring a thorough examination of the trees should be made in the winter to determine whether the black shining eggs have been laid at the bases of the buds. A very careful examination is required, because each egg is considerably less in size than a pin-head If such eggs are found, a spraying with tar-distillate emulsion should be made at 1 30 in the really dormant period, since if there is any movement in the buds injury will most probably result The only disadvantage in the use of the tar-distillate emulsions is that they are liable to cause a slight inflammation of exposed portions of the operator's skin, and it is advisable to protect the face by smearing with vaseline or by using a suitable mask. Spraying can be carried out from June onwards, but must be finished before the buds show any movement. The tar-distillate emulsions are prepared for spraying in the same way as are the ordinary oils—viz., the required amount of distillate is added to the same amount of water, this mixture being thoroughly emulsified before being added to the bulk of the water. There are several satisfactory proprietary brands of tar-distillate washes on the market.

The tar-washes cannot be used on any tree in foliage, the spray to use in the growing-period being nicotine sulphate 1 part to 800 parts of water, plus soap at the rate of 2 lb. to 3 lb. per 100 gallons of spray. The most important period to attack the aphides with this spray is in the spring, when the young succulent growth of the tree is often severely checked and stunted by the feeding of these pests, and it may be necessary to make persistent use of the nicotine spray at this period.

The green aphis of the apple, *Aphis pomi*, is usually of very little significance on apple, and probably does not call for treatment. If a spray is required the use of nicotine sulphate in the growing season as described above usually is sufficient. The same applies to this aphis on pear, where it is often quite serious.

As far as the woolly aphis of the apple is concerned, the success of the parasite *Aphelinus mali* has been so great that the need for spraying for this pest has largely disappeared.

GARDEN-PEA VARIETIES.

AGRONOMY SECTION, Plant Research Station, Palmerston North.

A STUDY of eighteen New Zealand seedmen's catalogues reveals the fact that forty-seven differently named garden-pea varieties are offered, and as many as thirty-three in a single catalogue. Amateur gardeners who desire to purchase seed of a few varieties must be greatly puzzled at times to make a choice from the many so attractively described, and it is hoped that the following notes may be of some assistance to them in this respect.

VARIETY.

In contrast to most other self-pollinated plants the garden pea is subject to variation, and indeed it seems impossible to attain such permanent uniformity as is possible in such a plant as wheat. In this state of constant instability it is often easy to develop by selection strains which differ one from the other to varying degrees, and it is difficult to decide just what degree of variation between two strains should be regarded as sufficient to warrant their recognition as two varieties.

In the first place, many of the varieties are catalogued under two or more names. Some growers know a variety by one name, others by another, and therefore both names are included. In the second place many of the varieties may have been at one time distinct selections, and therefore were given different names, but the distinction, if any, has disappeared or is so slight as to defy description, or can be observed only when the selection and the parent varieties are grown together. For all practical purposes they may be regarded as the same, since both will serve equally the one purpose, and both have generally the same origin. Finally, in such well-known varieties as Daisy, Stratagem, and others distinct strains have been selected, and, although distinctions can be drawn, they continue to be sold under the one original name.

MATURITY.

The catalogued descriptions might lead one to expect a wide range in maturity between varieties, but when they are sown together under uniform conditions a surprisingly large number of them mature together. The earliest varieties grown at this Station have been Benefactor and Early Market, the latest, Autocrat. The former carried filled pods in seventy-three days and the latter in one hundred days.

The period between sowing and picking depends also upon other factors. Thus early-spring sowing lengthens the period, and late-spring sowing shortens it. Rich land induces luxuriant growth and consequently delays maturity.

In general, early maturity is associated with a reduction in yield, and this is true whether the early maturity is induced by varietal differences, by the time of planting, or by soil conditions.

HEIGHT.

The height of the plant is not in any way associated with maturity. Tall varieties may be as early as dwarfs. Dwarf varieties are most popular, however, because they may be grown with the minimum of staking, especially if sown in double rows from 9 in. to 12 in. apart.

In general, dwarf varieties, especially the extreme dwarfs, are very poor in yield, when compared with medium-straw varieties, and if the difficulties associated with staking could be overcome the more prolific varieties would be grown more extensively. One or two notes may therefore not be out of place in discussing this matter of staking.

Peas will climb ordinary sheep or rabbit netting to a height of 5 ft. or 6 ft. with very little attention, and the same netting can be used for many seasons (fig. 1).

A method now adopted even for commercial plantings is to drive in firmly at intervals of 4 yards or 5 yards stakes 6 in. by 1 in. by 5 ft. high. The peas are sown in double rows 9 in. apart and later hilled. As the

FIG 1.

Left: Medium-straw peas climbing on 3 ft. wire netting.

Right: At a later stage the vines require an occasional tie-back to prevent them breaking away from the netting.

vines grow, fine lacing-wire is run down both sides of the double row at an appropriate height, lightly stapled to the intermediate stakes, and firmly stapled to the end stakes. Thus the vines are confined within the width of the battens by two strands of wire. Three or four sets of wires may be necessary in a medium-straw variety. The extra yield and quality of pods under this system more than compensates for the trouble and expense entailed.

Yield and Adaptability.

Garden peas are highly specialized in their requirements, and a variety that gives a satisfactory yield in one district may not perform

as well in another. The more popular varieties, like Greenfeast, are those that grow equally well in all districts. The discussion on varieties which is to follow applies mainly to experiences at this Station and therefore may not be true of all districts. This reservation is implied in all recommendations made.

Pods and Peas.

Large pods and peas are always desirable, but well-filled pods are desirable above all else. The colour of the peas will generally follow that of the pod, and should preferably be of a deep green. Some varieties like Daisy and Yorkshire Hero are handicapped in this respect, having peas of a pale-green colour, while one of the attractive features of Stratagem is its deep-green colour.

Varieties Catalogued.

In the catalogues to which reference has already been made fourteen varietal names are mentioned in at least nine cases out of a possible eighteen. Of these only eleven out of the fourteen may be regarded as distinct varieties. It may be concluded from the evidence of the catalogues that these eleven varieties are those most in demand, and therefore the most popular in New Zealand. Some comments on these eleven varieties will now be made.

Greenfeast.—This variety (known also under the names of Lincoln and Homesteader) is mentioned in every catalogue. It is deservedly the most popular variety, and should dominate all others in both private and commercial gardens. Its popularity is due no doubt to its hardiness, heavy yields, and wide adaptability. The pods are not large, and are very curved, but contain as many as ten dark-green peas of medium size. In the size of pods it falls short of such varieties as Stratagem. The vines grow to a height of about 3 ft. 3 in., and maturity is mid-season.

Stratagem is mentioned in all catalogues, and with it may be included Dwarf Defiance (mentioned thirteen times) and Te Aroha (nine times), making a total of forty. This is the outstanding quality pea, and in popularity ranks next to Greenfeast. Granted rich land and ample moisture Stratagem will give heavy yields of large straight dark-green pods containing seven or eight very large bold dark-green peas, which for culinary purposes are ideal. The vines are about 3 ft. in height, and maturity late. A considerable variation is to be observed in the lines of Stratagem, Dwarf Defiance, and Te Aroha offered by seedsmen.

William Hurst.—This is the only other variety mentioned in all catalogues, and one must conclude that it is in general demand. Why this should be is difficult to understand. It has been grown at this Station for several years, the seed being obtained from different sources, but it has, without exception, proved to be one of the poorest varieties grown. On the evidence of these trials there is no justification for its recommendation. It is a dwarf 1 ft. 6 in. in height, and as grown here matures as a second early.

William Massey is the local name for Kelvedon Wonder, and is mentioned in sixteen catalogues out of eighteen. Of the early varieties this is to be highly recommended. Like Greenfeast it has a wide range of adaptability, and the two varieties sown at the one time form an

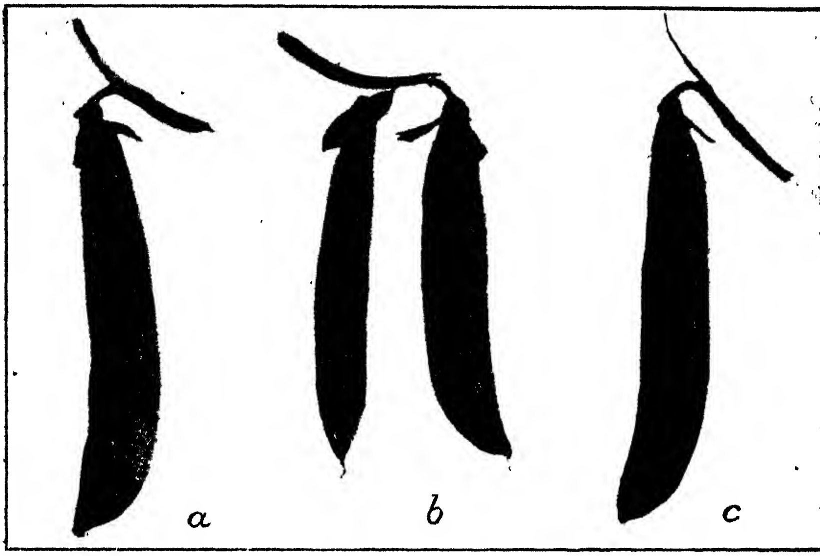


FIG. 2.
(*a*) Greenfeast; (*b*) William Massey; (*c*) Senator.

FIG. 3.
(*a*) Stratagem; (*b*) Daisy; (*c*) Lord Chancellor.

excellent combination, William Massey being ready to pick before Greenfeast. The vines are about 2 ft. 6 in. in height, producing a heavy crop of pods of medium size, containing up to eight peas of a medium-green colour.

Daisy, a well-known and popular variety, is mentioned in fourteen catalogues, and the Rev. Dr. Stuart in eight, making a total of twenty-two. The two varieties may be regarded as synonymous, but the position is obscured by the fact that, while the true "Carter's" Daisy is a dwarf 2 ft. 6 in. in height, there is another type, a medium-straw Daisy attaining a height of 3 ft. 6 in. to 3 ft. 9 in., which, in every other respect, is similar to the true dwarf type. The demand in the trade is for the dwarf form, although the yield is not as great as that of the medium straw. In many respects Carter's Daisy may be likened to Stratagem, but can be distinguished on account of the pale-green colour of foliage, pods, and peas. It is also decidedly earlier and more dwarf than Stratagem, and the pods and peas are not as attractive in appearance. It is, nevertheless, a variety that can well be recommended for general garden culture.

English Wonder is mentioned fourteen times and Richard Seddon twelve. Like William Hurst, this variety has consistently proved disappointing in all trials at this Station. It has rarely attained a height exceeding 9 in. to 12 in., each plant producing a very few small pods. On this evidence it cannot be recommended, although, as in the case of William Hurst, it may suit certain districts.

Yorkshire Hero (Great Crop).—Prior to 1926, at which time Greenfeast commenced to be known, Yorkshire Hero was perhaps the most popular variety. Its origin dates as far back as 1862, yet it is still in demand, has a wide range of adaptability, is a vigorous grower, and gives very heavy yields. The pods are short and blunt, containing relatively few peas, and these, although large, are very pale in colour. The vines attain a height of about 3 ft. 6 in. and maturity is mid-season. Its height and prolific growth, short pods, and pale peas, render it less desirable then Greenfeast as a garden variety, although in actual yield it will generally prove to be equally as good.

Sherwood.—This early dwarf variety has been grown only once at this Station. The pods were satisfactory in size and colour, but the general vigor and yield proved disappointing.

American Wonder is generally catalogued as an early dwarf, but at least two strains are available. One is as tall and as late as Yorkshire Hero, producing a prolific crop of small blunt pods each containing a few medium-sized pale-green peas. The other is more dwarf and far less productive, but neither strain can be regarded as a true early, nor can either be regarded as of high quality. It seems probable that the strains available in New Zealand differ materially from the original American Wonder, which originated as far back as 1875.

Little Marvel.—An early dwarf variety attaining a height of about 2 ft. and producing a prolific crop of short blunt pods very well filled with eight dark-green peas. A satisfactory variety for garden use.

Blue Bantam.—This variety has become very popular, largely, it may be assumed, on account or the large dark-green pods and peas, associated with its dwarf and early habit. In many respects the variety is

similar to Pioneer and Peter Pan, except that in trials at this Station Blue Bantam was decidedly more dwarf, slightly earlier, and less prolific. This variety, or one of those of the same general type such as Pioneer, Peter Pan, Hundredfold, Laxton's Progress, and Laxtonian, can well be recommended for culture in private gardens.

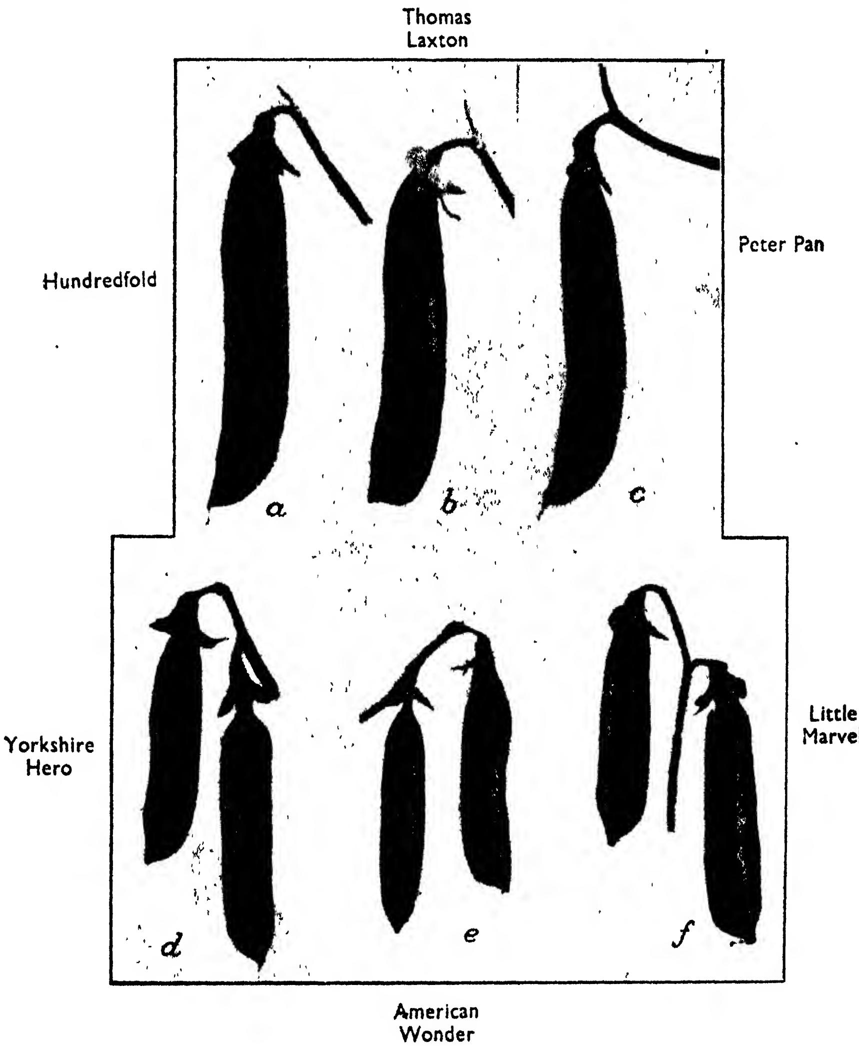


FIG. 4.

(*a*) Hundredfold; (*b*) Thomas Laxton; (*c*) Peter Pan; (*d*) Yorkshire Hero; (*e*) American Wonder; (*f*) Little Marvel.

VARIETIES NOT COMMONLY GROWN.

The varieties so far discussed are those apparently best known to private and commercial gardeners. The bulk of them are of dwarf growth, a few of medium straw, but none of them is tall. By excluding

all tall varieties the private gardener limits the range of varieties that might be grown with advantage, and excludes some of those that attain the highest quality. A few of the varieties that have given a satisfactory performance at this Station might therefore be mentioned.

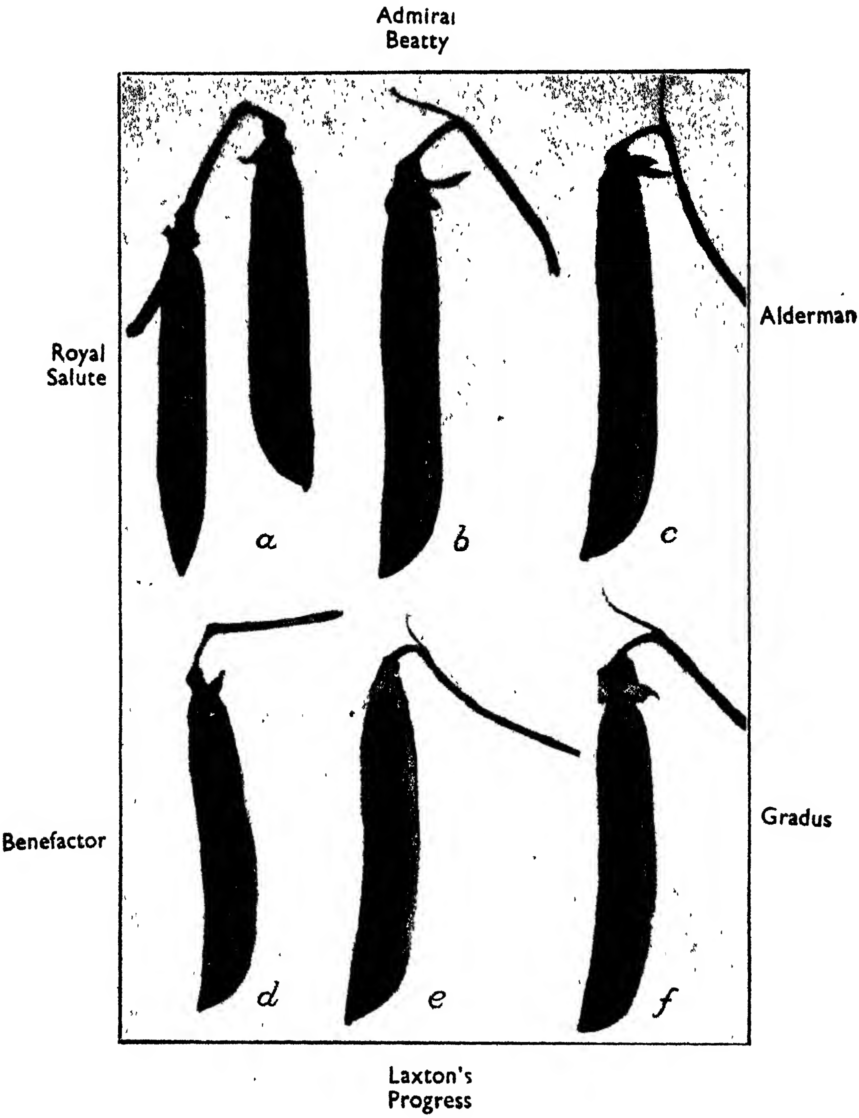


FIG. 5.

(a) Royal Salute, (b) Admiral Beatty. (c) Alderman; (d) Benefactor; (e) Laxton's Progress; (f) Gradus.

Of all varieties tested the earliest have been Benefactor and Early Market, followed by Thomas Laxton. These attain a height of about 4 ft., are non-branching, and require careful staking. The pods are

large, well-filled, and the yield satisfactory for such early maturity. At the other extreme is Autocrat, always the latest to mature. It is of an extremely vigorous habit, attaining a height of 4 ft., and producing an abundant crop of dark-green pods and peas of high quality.

Gradus and Admiral Beatty are both tall, second-early varieties that have given consistently good results, and when staked produce a prolific crop of handsome pods. Alderman is mid-season, and grows to a height of 5 ft. or 6 ft. The large, handsome pods and peas are dark-green and of the highest quality. Duke of Albany may be regarded as synonymous with Alderman, and both varieties are catalogued in New Zealand.

Senator is a branching and vigorous variety, attaining a height of 3 ft. 6 in. to 4 ft., and producing a remarkably heavy crop of pods which, however, contain few peas, and these are pale green in colour Union Jack and President are dark-podded forms of Senator. The pods are curved as in Greenfeast.

Lord Chancellor and Royal Salute are indistinguishable one from the other. Growth is vigorous, attaining a height of about 3 ft. 6 in. The pods are large and dark-green in colour, but the peas are not particularly large, and the number in the pod is disappointing.

Pioneer, Hundredfold, Laxton's Progress, Laxtonian, and Peter Pan form a group of varieties of very similar characteristics almost any one of which would serve the purpose of the others. They are all early or second early in maturity, and are satisfactory in respect to yield and size of peas and pod. Seed of some or all of them is available, and their cultivation in private gardens could well be extended.

Southern Cross (Onward) is a recent and promising introduction of medium height, pale foliage, and large blunt pods.

SUMMARY.

Summarizing the varietal position in the light of trials conducted at this Station, the following recommendations can be made in respect to varieties of which seed is available as indicated by the catalogues studied :—

Early—
William Massey ; Little Marvel ; Blue Bantam ; Pioneer ; Peter Pan ; and other similar varieties.

Second Early—
Gradus ; Admiral Beatty.

Mid-season—
Greenfeast ; Yorkshire Hero ; Daisy ; Alderman ; Senator.

Late—
Stratagem ; Lord Chancellor.

Crystallizing the position still further to within the scope of the average private gardener, the following may be recommended :—

Early—
William Massey.

Mid-season.
Greenfeast.

Late—
Stratagem.

—*J. W. Hadfield, Agronomist, Palmerston North.*

CHEWINGS FESCUE SEED.

THE INFLUENCE OF TEMPERATURE AND MOISTURE CONTENT UPON THE RATE OF LOSS OF ITS GERMINATING-CAPACITY.

E. O. C. HYDE, Assistant Seed Analyst, Palmerston North.

THE export trade in Chewings fescue seed from this country has in the past been seriously prejudiced by the frequency with which deliveries have been rendered unsatisfactory through loss of germinating capacity during transport. Recently Foy* has shown that this disability may be removed by shipping seed of low moisture-content in sealed containers. It is anticipated that advantage will be taken of these findings and that the drying of Chewings fescue seed before shipment ultimately will become a general practice.

The methods of drying seed which are being given first consideration are those where the excess moisture is removed by heated air of low relative humidity. When controlling such a drying process it is of advantage to know to what conditions the seed may be submitted without endangering the germinating-capacity. The present work was undertaken with a view to providing information upon this point.

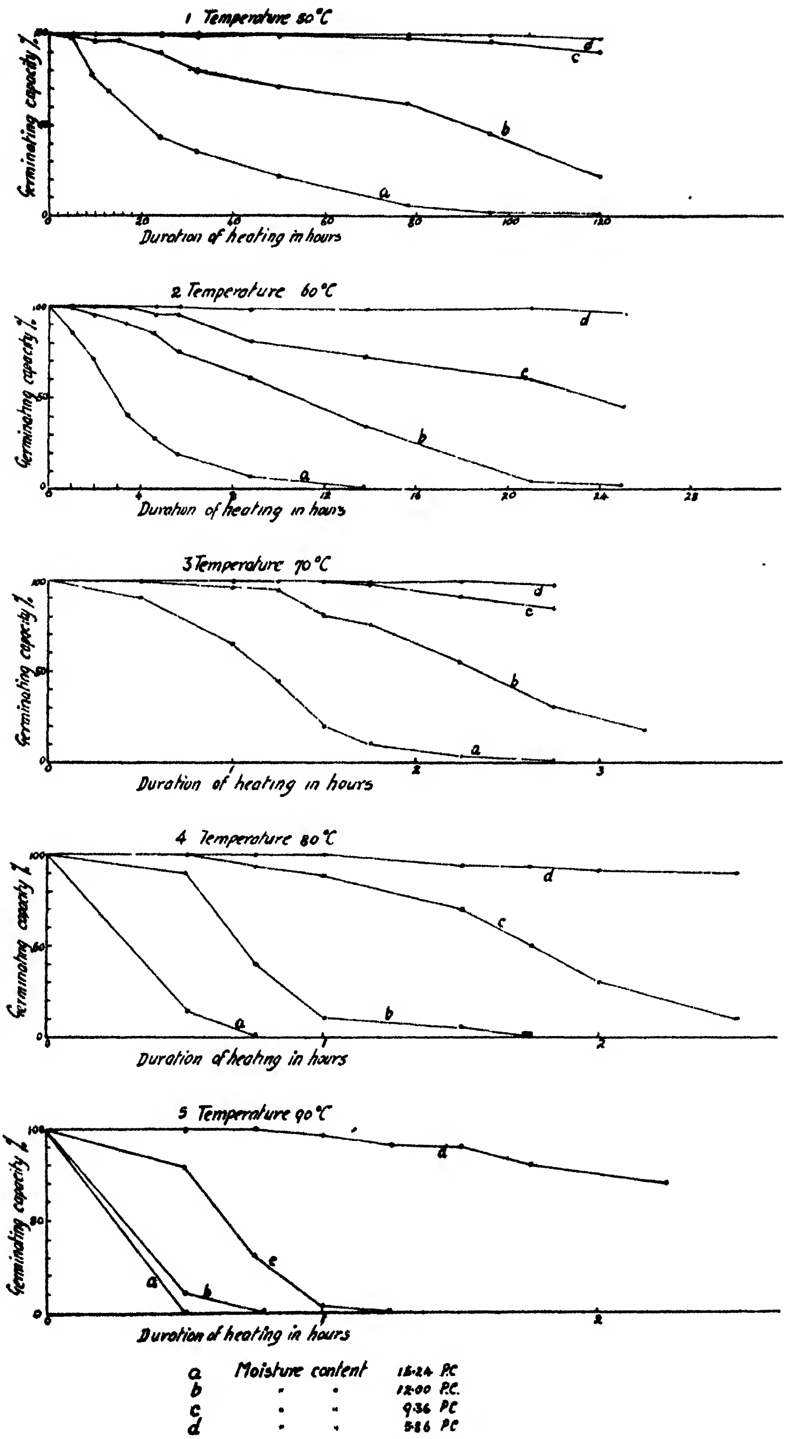
The seed used had been harvested about twenty months previously. The germinating-capacity when received was 78 per cent. and the moisture-content 12·4 per cent.

Four lots of seed were taken from the bulk and the moisture-content adjusted in order to obtain a range between six per cent. and fifteen per cent. To increase the moisture-content of one lot the seed was placed for three hours in a warm chamber over a free surface of water. To reduce the moisture-content of other lots the seed was placed in an electric drying-oven through which a current of air at 40° C. was passed. The seed was removed when the requisite moisture-content was reached. The four lots of seed were then stored for three weeks in sealed containers in a cool place. Before the continuation of the experiment the moisture-content of the four lots was found to be respectively 5·86, 9·36, 12·00, and 15·24 per cent. The germinating-capacity was 78, 78, 76, and 74 per cent. respectively.

The determination of moisture-content was made by heating a weighed quantity of the seed for five hours at 103° C. in a ventilated oven. The seed was then removed to a dessicator to cool before re-weighing. The moisture-content is expressed as a percentage of the dry weight.

The heating treatments were carried out in the following manner: Small samples of each lot of seed in sealed phials of ¼ in. diameter were placed in an electric oven at constant temperature. At intervals samples were removed and a record made of the temperature and duration of treatment. Germination tests were made within a week after treatment.

* FOY, N. R.: *N.Z. Journal of Agriculture* (1934), 49 (7), 1.


1 Temperature 50°C
Germinating capacity %
Duration of heating in hours
2 Temperature 60°C
Germinating capacity %
Duration of heating in hours
3 Temperature 70°C
Germinating capacity %
Duration of heating in hours
4 Temperature 80°C
Germinating capacity %
Duration of heating in hours
5 Temperature 90°C
Germinating capacity %
Duration of heating in hours
a Moisture content 15·24 P.C.
b " " 12·00 P.C.
c " " 9·36 P.C.
d " " 5·86 P.C.

The results are presented in the accompanying graphs. The germinating-capacity after treatment is given as a percentage of the germinating-capacity of the untreated control sample. It is very apparent that the resistance of the seed to injury from heating is greatly increased by reduction of the moisture-content.

From a practical point of view it is of special interest to see at what point the germinating-capacity begins to decline. The accompanying table shows the maximum length of time, as determined in these experiments, for which seed of given moisture-content may be heated at specific temperatures without impairing the germinating-capacity.

It is necessary to draw attention to several considerations which tend to diminish the accuracy or limit the usefulness of these results.

Firstly, although the thermostat on the oven was highly efficient, the necessity of opening the oven at intervals to remove samples caused fluctuations in the temperature which, when higher temperatures were used, extended to as much as 3° C. in the seed within the phials.

Secondly, the heating and cooling of the seed necessarily are gradual processes, and this must be a source of considerable error where the duration of the heating is short and the fall in germinating-capacity rapid. Reading from a thermometer inserted within one of the phials of seed showed that when the difference between the room temperature and the oven temperature was 70° C. twenty-one minutes were occupied in raising the seed to the temperature of the oven.

Thirdly, the seed used in the experiments was nearly two years old and had a germinating-capacity of 78 per cent. It may be assumed that this seed would be more susceptible to injury from heat than would be seed of greater vitality. It is considered, however, that this does not militate against the usefulness of the results. If the limits of safety in treating seed as determined in these experiments are taken as a guide, it is improbable that any newly harvested line will suffer injury.

Upon consideration of the present findings, and in the light of experience already gained in the drying of Chewings fescue seed, it can be asserted with confidence that an efficient plant may be operated at temperatures high enough to accomplish rapid drying with yet an ample margin of safety from the danger of injuring the vitality of the seed.

Maximum Period of Heating of Chewings Fescue Seed without Resultant Diminution of Germinating-capacity (in Hours).

Moisture-content (Percentage).	Temperature (Degrees C.).				
	50	60.	70.	80	90.
15·24..	5	..(*b*)	..(*c*)	..(*c*)	..(*c*)
12·00..	8	1	½	..(*c*)	..(*c*)
9·36..	80	3½	1½	½	..(*c*)
5·86..	120(*a*)	21	2½	1	¾

(*a*) Maximum period used in these experiments.

(*b*) Significant reductions in germinating-capacity in minimum period used (1 hour).

(*c*) Significant reduction in germinating-capacity in minimum period used (½ hour).

LIVE-STOCK POISONING IN NEW ZEALAND.

(Continued from May, 1935, Journal.)

POISONOUS PLANTS AS FOODS.

B. C. ASTON, Chief Chemist, Department of Agriculture.

THERE is nothing new in the statement that poisonous plants may be excellent food-plants under certain conditions. In the case of humans the conditions under which a poisonous plant may be used safely for food are so well known and the procedure in preparing it for human food has become so fixed that the necessity for closely observing the right conditions has often been lost sight of and only remembered when a deviation from the routine practice results in illness from eating such abnormally prepared food.

The most striking example of this need for extreme care in following the established practice is the case of the potato, which belongs to a family (*Solanaceae*) containing a number of very poisonous members. The green parts of these plants are usually poisonous, but the fruit when quite ripe is often highly nutritious and palatable, as, for instance, the tomato, the cape gooseberry, the egg plant, &c. Fortunately the unpalatable nature of the unripe fruit usually acts as a deterrent to their consumption even by children. The green parts of the potato are similarly poisonous to human beings, so that cooks usually discard any tubers or parts of them which have become greened by exposure to light. A few years ago very high winds blew away the soil covering from the growing potato crop, exposing large quantities to the light, and as a result several cases of potato poisoning occurred in the North Island that year. Green potatoes should be used only for seed, for which they are more suitable then the blanched tubers. If continuous access of light to the tubers is permitted they become green and poisonous alkaloids are formed, the green colour being the danger signal. Another excellent example of the necessity for following the correct technique in preparing food is that of rhubarb, the stalk of which is highly esteemed as a vegetable food, but the leaf of which is poisonous. During the Great War when vegetables were scarce the poisonous nature of the leaf blade was overlooked, and attempts to utilize it by boiling it as greens resulted in several poisoning cases and even fatalities.

Sometimes it is a question of the relative amount eaten which is the deciding factor whether the plant will exert its acute poisoning effects or not: thus the pepper, mustard, and nutmeg act as poisons when taken in excess, although when taken in the customary quantities with other food they are useful flavouring ingredients or appetite-stimulants. The statement that one nutmeg will kill a man is certainly a striking example of the need for moderation even in the use of a familiar domestic condiment.

The domestic animal may safely be left in most cases to choose the food that is good for it, given a reasonable latitude and range of food materials. The animal, and this includes fowls, penned up or tied up under artificial conditions may eat any poisonous plant within reach. Fowls in a run will eat South African box-thorn leaves (another poisonous solanaceous plant) and die, cattle on turnips will break out and gorge themselves on tutu, resulting in 100-per-cent. mortality. A horse tied to a poisonous tree will browse it will ill results. Starved

driven calves will browse pimelia in default of something else to eat, and a heavy mortality will occur among them, although in their home paddocks where there is no lack of good pasture they will not touch pimelia, which causes blistering of the mouth and throat and must be extremely distasteful to the normal animal.

One exception to the statement that an animal will select food that is best for it if it is available is that curious phenomenon of what is called a drug habit, where the animal obtains some after-effect which for a time stimulates it. This condition may be perhaps compared to that of the opium-eater in the human being. Cattle, after they have once acquired a liking for ragwort, will search out plants in a paddock and eat them in preference to normal pasture. This is also the case with the bracken fern. These plants probably contain compounds which stimulate the action of certain glands, producing a pleasant result in the animal which it becomes desirous of having continued, but the final result is disastrous.

The Karaka (Corynocarpus laevigatus) as a Food Plant.—The ancient Maori knew that the kernel of the karaka fruit was poisonous in its raw state; he also knew that the tutu fruit was poisonous, although in this case very sweet and palatable. In both instances he discovered how to destroy or avoid the poison, and by heating and steeping the karaka fruit in running water and by screening off the poisonous seeds of the tutu made use of palatable farinaceous food in one case and in the other prepared a refreshing sweet drink.

Karaka *(Corynocarpus laevigatus)* is a dark-leaved evergreen tree from 25 ft. to 50 ft. in height, with a trunk from 1½ ft. to 2½ ft. in diameter, and is one of the most attractive small trees of New Zealand. The leaves are very similar in shape and size and general appearance to the well-known cherry laurel, but the fruits, which are more abundantly produced in some years than in others, are large orange-yellow drupes like small plums, which they resemble in size and structure, having an outer soft pulpy sugary covering, the sarcocarp, a tough leathery fibrous inner covering, the endocarp (corresponding to the shell of the plum), and the contents of the shell, the poisonous and bitter-tasting seed or kernel.

It has been said that in times of scarcity of food it is the established practice for the farmers in the Manawatu and Taranaki coastal districts who have karaka-trees on their property to cut down branches, thus enabling the leaves of the karaka to be devoured greedily by cattle. The fruit of the karaka is, however, generally regarded as poisonous taken as a whole, although the pulpy outer cover is fairly palatable and has a flavour which may be likened to that of an inferior date. These fruits, variously called "nuts" or "berries" by the farmer, are undoubtedly poisonous to many forms of life if the kernel is eaten raw. The poison is due to a compound or compounds which under certain conditions evolve hydrocyanic (prussic) acid, one of the most deadly poisons known. The existence of this type of body in small quantities in many fodder plants is known, but only in a few is the quantity sufficient to cause anxiety. In the sorghum and similar plants in certain seasons and at certain stages of growth enough prussic acid is generated to cause mortality in stock. It would appear, however, that the presence of similar cyanide-generating compounds (cyanogenetic glucosides) in the kernel is no bar to their consumption by sheep and lambs, which can consume them not only with impunity, but with great advantage to themselves

and their owner. The karaka probably, therefore, has an additional economic value to the sheep-farmer on account of the food-value of the fruit, especially in times of drought, when the pasture is burned up and there is no other food except the karaka fruit, which drops from the trees in autumn before the rains bring on the pasture. A well-known land-owner at Hawke's Bay recently informed the writer that the sheep are so fond of the fruit that they detect the sound made by the dropping "nuts," which reminds them of new food and prompts them to hasten to the spot, where the falling "nut" is eagerly sought for. Sheep eat the entire fruit, including the kernel. Evidently there is some treatment which the "nut" receives in the digestive machinery of the sheep which inhibits the generation of prussic acid. The most convincing account of the value of karaka fruit as a supplementary food for lambs comes from a Martinborough farmer, who writes under date 8th March, 1935 The letter was kindly sent me by Mr. D. A. Gill, District Superintendent, Live-stock Division, Wellington. "My lambs," he says, "live largely on karaka berries for a period after weaning every year, and this year, as owing to the drought there has been no grass, they have lived entirely on them for some weeks For roughage they have had nothing but leaves, some fern, and a little dry grass. They do not seem to eat much of the roughage, but prefer to remain under the karaka-trees, where there are more berries than a small mob of 330 lambs can cope with. When I got the lambs in I was more than pleased with their condition. Although they had had no grass they had grown nearly ½ in. wool and put on fat in three weeks. The paddock they were in is 45½ acres cleared and, say, 15 acres bush, mostly karaka-trees. On 26th January I put 330 lambs in it. There was then no grass at all, but the berries were starting to fall plentifully. On 29th March I took them out again. The berries were then over, but grass was plentiful. During the time the lambs were on the karaka paddock they ate ¼ cwt. salt lick and 100 lb. maize and 100 lb. linseed nuts—that is only a few handfuls for each of the 330 lambs, but they did not seem to want more." This farmer adds some interesting matter with regard to other animals. The whole berry is eaten by all animals except rats, rabbits, &c., and it is the kernel which contains the nutriment. Sheep, cattle, deer, and goats chew the kernel before swallowing it, while pigs swallow most of it whole and merely digest the pulpy covering, voiding the kernels.

The chemical analysis of the karaka fruit made in the conventional way for indicating the relative food-value compared with other similar food materials is summarized in the following table :—

—	Percentage Water.	Percentage Ash.	Percentage Protein.	Percentage Fat.	Percentage Carbohydrates.	Percentage Phosphoric Acid (P_2O_5).
Beech-nut cake(1) ..	15·1	4·72	18·7	..	..	1·00
Rough rice(2) ..	9·6	4·90	7·6	1·9	76·0	..
Acorns(2)	27·9	1·10	3·4	4·4	63·2	..
Karaka pulp (sarcocarp)*	10·1	7·47	7·95	..	36·4	0·57
Karaka (kernel)* ..	20·1	2·84	11·70	10·9	45·1	0·36

* Analysed by F. B. Shorland.

The whole karaka fruit therefore compares very well in analysis with the other low-grade foods and food-products.

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SUPPLIES OF PAMPAS-GRASS.

THE means by which pampas-grass is propagated are three—(1) By seed, (2) by wild seedlings; (3) by root-cuttings.

Seeds are obtainable only from Messrs. Sutton and Sons, Reading, England, who supply seed giving a germination test of from 60 per cent. to 70 per cent. for 12s. 6d. per pound; shilling packets are also obtainable. This firm has agencies throughout New Zealand, the chief agents being Messrs. J. G Ward and Co., Christchurch. It is doubtful if any seed is on sale at present, and it would probably have to be ordered from England. A pound of cleaned seed would contain approximately 1,800,000 seeds

Seedlings.—Regeneration of pampas from seed takes place in many areas near and north of Auckland City, but attempts to obtain seed from mature plumes gave only a small yield The Harbour Board, Whangarei, supplies seedlings at 30s. per 1,000. Seedlings, either raised from seed or collected from wild plants, should, of course, be raised to a size suitable for planting out. Planting must be done when all danger of frost is over. When a year old, plants should be large enough to plant out in their final home, the area being securely fenced. The grazing must be rigidly controlled, as continuous grazing by stock will kill the pampas in time

Root-cuttings.—This is the most precarious method of establishing a plantation of pampas, owing to the heavy mortality which may ensue from droughts. Last year, owing to the unusually dry seasons, plantings of root-cuttings were subject to a higher mortality. Root-cuttings may be obtained from any nurseryman, or from certain farmers in the Hauraki Plains and elsewhere. The price varies, according to the vendor, from 10s to 50s. per 100

—*B C. Aston, Chief Chemist.*

SEASONAL NOTES.

THE FARM.

Feed Utilization of Importance.

OFTEN there are substantial differences in the amounts of butterfat, fat lamb, wool, &c., produced on adjacent farms which naturally are similar. As a rule, the basic cause of these differences lies not in the respective feed-producing capacities of the farms, but in the way in which the feed produced is used and at times modified by grazing treatment. In other words, the production of many farms could be increased materially, with little or no additional cost in respect to such practices as top-dressing, drainage, &c., merely by making more effective use of the feed the land is already capable of producing. Increased production brought about essentially by improved utilization of pastures is directly associated with lowered cost of production so urgently desirable during the current period of relatively low prices of farm-produce. The matter is of importance at this time of the year because much can be done within the next few weeks to foster improved utilization of feed from grassland during future seasons.

An aspect of prime importance is the avoidance, as far as is practicable, both of unduly severe grazing in the winter and early spring and of the development of rough, stemmy growth in the summer, two faults which often occur on the same farm and which commonly can be miminized by (1) extension of the practice of ensilage, (2) the adoption of improved grazing management, and (3) increased production, though not necessarily increased acreage, of such supplementary crops as lucerne, mangels, swedes, carrots, chou moellier, and, when pigs are to be fed, possibly barley and peas. On some farms one or two, on others, all, of these developments are desirable. The objective of all of them is the avoidance of periods of excessive supply of feed alternating with periods of harmful scarcity.

Often an increase in the area for ensilage is a proper initial step, and for this the construction of trenches or pits may be advisable as contributing to the lessening both of the labour and the wastage involved in ensilage. Full particulars about the provision of suitable trenches and pits may be obtained from district officers of the Fields Division. There are very few farms on which either a trench or a pit could not be located suitably, and often all that is called for is the labour of making the excavation, it being possible to dispense quite well with the purchase of material for walls, &c.

At times a useful auxiliary to extension of ensilage as well as to improvements in grazing-management may be closer subdivision by the erection of internal fences, but on a great number of farms much improvement could be made without any additional fencing—for instance, as a rule, reasonably good grazing-management can be carried out on a dairy-farm consisting of nine or more paddocks fairly uniform in feed-production To obtain good grazing-management such subdivision needs to be associated with alternate spelling and heavy stocking of pastures at intervals as great as is possible, consistent with the type of feed that is suitable for the stock, and with the avoidance of herbage of the stemmy or woody character that is correlated with the development of flower-heads.

As much as is practicable may be done in respect to ensilage and to grazing-management, and the feed-position still remain weak unless some supplementary cropping is carried out. One reason for this is that silage as commonly made is not entirely suitable as a feed for milk-producing animals during the shortage of leafy feed directly available from pastures, a shortage which commonly occurs about midsummer, and subsequently for several weeks. The silage usually available is somewhat fibrous in

comparison with feeds of the nature of soft turnips or green, leafy lucerne which experience has shown to be excellent for use at this season. Another reason is that often it is neither practicable nor advisable to create sufficient reserves of silage. It has to be borne in mind that sufficient reserves of feed, if consisting wholly or even mainly of silage, require to be really substantial; the amount of silage that can be saved in any particular year varies so much with variations in the weather that it is unsafe to place too much dependence on silage unless the amount in reserve provides for the needs of more than one year. When such a reserve of feed cannot be created readily it becomes advisable for the sake of safety to make use of special crops suited to the circumstances. This makes it necessary for many at this stage to consider the amount and location of the grassland it is advisable to put under the plough during the coming season. In planning this, certain facts provide guidance.

Firstly, the special provision made for the critical seasons in which the feed directly available from grassland is below the needs of the stock is frequently inadequate—sometimes markedly inadequate. Particularly in dairying, but also in sheep-farming, there often would be more profitable results were the plough more freely used as a means towards better feeding. Secondly, the breaking-up of many pastures is desirable, because either they are too open or they contain unduly inferior pasture-plants.

Aspects of Sward-improvement.

Commonly sward-improvement is effected by following one of two radically different courses—(1) Breaking up and eventual reseeding after one or more arable crops, (2) ameliorating an established pasture by top-dressing, surface-sowing of seed, &c. According to the circumstances, either of these courses may be advisable.

At times fertilizers have given remarkably good results in increasing the vigour and the yield of the good species in a pasture—one or two dressings of phosphates in certain circumstances may bring clovers, rye-grass, cocksfoot, and dogstail into prominence in pastures in which these species prior to top-dressing fare so badly that it would be easy to overlook their presence. But that the species mentioned be really present, though faring but poorly, is a matter of basic importance; the presence of such species which are capable of responding profitably to better treatment is the basis of any worthwhile improvement. In cases of their absence they, at times, have been introduced successfully by surface-sowing of suitable seed following harrowing or other cultivation drastic enough to provide sufficient loose soil to ensure a seed-bed of some service. A certain amount of risk and uncertainty attaches to the surface-sowing of seed on established pastures, but against this, under favourable circumstances, quite good results have been obtained at a very low cost.

Because of the risk attaching to surface-sowing the standard and generally preferable course is to plough and reseed, usually after a series of arable crops, deteriorated pastures which do not contain sufficient numbers of desirable pasture-plants to ensure a satisfactory amount of improvement following such practices as top-dressing and harrowing. A material advantage of this standard course is that it may provide, immediately after sowing, a high-class pasture. Probably a pasture of equal standard could not be obtained at all by any other means, but if it could, then, as a rule, only gradually and after a considerable interval. Drawbacks to the standard course are the outlay and the labour it involves. Despite these drawbacks, the practice of ploughing and reseeding worn-out pastures, if it is at all possible, should be adopted. The advisability of this has been intensified greatly by the availability through certification of reliable supplies of seed of superior and lasting strains of such important species as perennial rye-grass, white clover, cocksfoot, and red clover. In certain circumstances sward-improvement based on arable work may not be practicable because

of labour or cost considerations, or because of the hilly or sandy nature of the land, or because of both. In this case the advisable alternative course is renovation by top-dressing, surface-sowing, &c.

Causes of Sward-deterioration.

Improvement of swards by whatever means it is carried out is always a relatively costly undertaking. The causes of deterioration, some of which can be eliminated, are therefore of moment. Among the common causes are—

(1) Lack of adequate and available supplies of the materials needed in the nutrition of the plants it is desired to have prominent in the pastures. As a rule the remedy for this is suitable top-dressing, but at times improved drainage is called for as a means of fostering the action of small soil-organisms which improve the availability of plant-food materials, especially nitrogenous ones.

Replacement of rye-grass and cocksfoot by brown-top or other twitches, replacement of white clover by suckling clover, the ingress of flat weeds, such as rib-grass and dandelions, all are indicative of lack of fertility leading to deterioration of pastures and give promise of most satisfactory results from top-dressing, provided the deterioration has not proceeded to such an extent that the superior species have disappeared altogether, but still persist, although weakened and inconspicuous.

If improved fertility through such measures as top-dressing and drainage is needed, then until it receives attention the sowing of good seed of species with requirements above the current level of fertility tends to be futile. At times this seems to be ignored completely. For instance, a sward inferior because of deficiency of plant-food is broken up and arable crops, which impoverish the soil, are grown before the land again is sown in grass. Actually it is not reasonable to expect an improved permanent pasture until the fertility is made greater than it was prior to the impoverishment by the exhausting crops In such circumstances any cropping prior to the sowing of permanent pastures should serve to increase instead of to deplete the fertility. Though this may seem obvious, in practice it is ignored in those many cases in which such crops as oats, maize, and millet precede permanent pasture, especially when the fertility of the land tends to be below the requirements of the class of pasture sought. If prior cropping has worn out such land, then liberal fertilizing should be linked with the sowing of permanent pasture.

(2) Unsuitable grazing-management often is a substantial factor in sward-deterioration. A very common form of unsuitable management consists of over-severe grazing in the winter and early spring, which has an especially harmful influence on the composition of pastures, when, as frequently, it occurs in conjunction with undergrazing in the summer and autumn. In pastures which repeatedly are overgrazed in the winter and spring and under-grazed in the summer and autumn there may occur readily a decline in perennial rye-grass and an increase in brown-top unless the fertility is above the average level.

(3) A most serious cause of rapid and extensive deterioration of pastures, commencing from a few months after their establishment, is being removed speedily with extension in the use of certified seed of such plants as rye-grass and clovers. The use of strains of these plants, which really are not capable of persisting, even under very favourable conditions of soil and climate, has led to much past rapid deterioration of pastures. A farmer who tolerates such deterioration in the future can blame only his failure to make use of the advances in our grassland work.

(4) Because of the ravages of grass-grubs, pastures may contain so few plants of valuable species as to warrant ploughing as a first step towards the establishment of a good sward by resowing. On the other hand, if the damage caused by the grubs is not too extensive it usually is distinctly

helpful to concentrate, as far as possible, the feeding-out of hay, roots, and other fodder on the areas infested with the grubs. At times the feeding-out of hay made from herbage in which seed-production has taken place brings about the surface-sowing of valuable species in useful amounts. Suitable top-dressing assists by building up the vigour of injured plants, thereby enabling them to develop new roots and to survive.

General Work with Pastures.

Much useful top-dressing may be done in July and August by those whose prior top-dressing programmes have been inadequate. Generally, the use of superphosphate at this season may be recommended. Farmers who seem to be threatened with an acute shortage of feed in August and September may well give consideration to the use in late July or August of sulphate of ammonia or analogous nitrogenous manures. Some guidance relative to this was given in these notes for the previous month.

Grass-harrowing, especially for the purpose of breaking up and distributing droppings, very generally calls for attention during July and August.

Young pastures, and particularly those in which permanency is desired, should be treated with especial care at this season. Sheep, if they are not allowed to graze too closely, are preferable on young pastures to cattle, which increase the danger from "poaching" or "pugging," which should be avoided as far as is practicable and which at times leads to the wholesale establishment of such weeds as thistles, buttercups, and docks. In trying to avoid pugging one may fall into the error of undergrazing of young pastures. Young permanent pastures containing a considerable amount of Italian rye-grass are prone to suffer from undergrazing because of the shading and consequent weakening effect of the Italian rye-grass on more slowly developing species valuable in a permanent pasture

General Cropping-work.

Especially in the South Island, the speeding of ploughing and other cultivation work, provided the soil is dry enough, is particularly desirable in the preparatory work for cereals, and it is similarly, though not so urgently, desirable in preparation for such crops as lucerne, mangels, and potatoes. When old swards are being broken up for these crops it often is advisable to fit a skimming attachment to the plough in order to bury completely the surface layer with its complement of weeds

From experience it has become customary, in the principal cereal-growing areas, to sow the bulk of the spring wheat crop in August and early September. The sowing of oats, as a rule, should be carried out as soon as the attention required by the wheat crop allows. Black skinless barley often may be sown advantageously in August.

Autumn-sown cereals, if they are to be utilized eventually for the production of grain or chaff, should be given a final grazing about the end of August. However, if "lodging" of the crop is anticipated, then the final feeding-off may well take place in September. Generally after this feeding-off it is advantageous to tine-harrow cereals: this serves to loosen the trampled surface and to break up and scatter droppings Spring feeding-off of cereals should be done by stocking heavily for a short period, and this preferably when the soil is as dry as possible.

Harrowing of autumn-sown wheat, if it is somewhat thin, is often advantageous, even if feeding-off has not been carried out: the harrowing tends to increase the tillering and so thicken the crop.

Seed-treatment for the control of disease in spring-sown cereals should not be overlooked. Oats, even if intended not for grain but for chaff-production, should be treated, since chaff from a smutted crop is of less value than chaff from a similar clean crop. Seed-treatment if not carried out correctly may be futile or even harmful. Full information about approved methods of treatment may be obtained from local officers of the Fields Division.

Winter Utilization of Crops.

That winter rations should be suitable in quality as well as in quantity seems sometimes to be overlooked. Merely filling the stomach is not sufficient, the necessary amount of nutriment should also be present. The feeding of roots alone is an illustration: it gives too much watery bulky material in the diet. A contrasting unsatisfactory diet is that provided by straw or poor hay—bulky and indigestible. While it is mainly the bulkiness of the roots which detract from them as an exclusive ration, the straw or poor hay fails on account of both bulkiness and indigestibility. A ration containing roots may be balanced satisfactorily by the use of good hay, but poor hay or straw may call for the use of grain or other concentrates to obtain good results

In the feeding of silage to sheep 2 lb. to 3 lb. a head daily may be looked upon as a substantial contribution to the ration for the purpose of supplementing a scant supply of fresh grass. If sheep which are to be fed on silage have not consumed it previously, then the silage should be introduced into their keep before they have become markedly low in condition—sometimes sheep start to eat silage only when they have been reduced to a hungry condition, and sheep in fairly good condition can withstand a period of hunger better than ones in weak, low condition.

There is a vital difference between the standard of winter feeding required by dairy cows and that required by several other types of farm stock. For the dairy cow the period in which she is not producing milk should be one of recuperation and of replenishing of important bodily reserves. This can be achieved only if the cow is fed above the standard of mere maintenance and not below it, as is the case when cows not producing milk fall off in condition.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Cultivation.

THE importance of early and thorough cultivation of all orchard land cannot be over-stressed. Late autumn or early winter is the best time for ploughing in a cover crop. If there is no cover crop, there is almost bound to be an abundance of green vegetation, which, when turned in at this time, after decay, improves the ground, while the action of frost on the turned-up soil not only helps to sweeten it but pulverizes it as well, the benefit of which will be very noticeable during the necessary subsequent cultivation required to bring the soil to a fine tilth. That portion of land around each tree that cannot be ploughed should be dug, and all decayed leaves, &c., buried if possible before the trees commence growth. This prevents the dissemination of spores of fungi from this source while the buds are opening and very susceptible to attack.

Foundation Sprays.

The success of disease-control depends not only on spraying with the correct mixture, but applying it at the correct time with sufficient force to drive it into every corner and crevice of the tree. Even this is inadequate unless the operator is thorough and every twig, leaf, fruit, and branch of the tree is well covered. It is of the utmost importance that the ingredients should be weighed accurately, for the guessing of weights frequently leads to inefficient disease-control or heavy losses due to spray-burn.

The most effective fungicidal foundation spray for the control of such diseases as leaf-curl, die-back, brown-rot, spot-hole, bladder-plum, &c., is Bordeaux mixture, and the strength recommended is 5–4–50—*i.e.*, 5 lb. copper sulphate, 4 lb. hydrated lime, 50 gallons water. This spray should be applied to all stone-fruit trees. In the case of varieties of peach

and nectarine that are particularly susceptible to leaf-curl, or where one application usually does not give a satisfactory control of any of these diseases, a second application should be made. The time for the first application is at or just prior to the first sign of bud-movement, and the second from seven to ten days later. When an application has been made in the autumn the first spring spraying can be omitted.

The hydrated lime must be of good quality, containing not less than 90 per cent. of slaked lime—*i.e.*, $Ca(OH)_2$; if the content is less than this, adjustment must be made accordingly.

The dormant spray for the control of sucking insects, such as red-mite, mussel scale, San Jose scale, woolly aphis, mealy bug, &c., should be applied as early as possible after pruning and before there is any appreciable bud movement to pome-fruits and during the dormant period to stone-fruit trees. Winter spraying-oil is indispensable for this purpose, and should be applied at a 3 per cent. concentration, and for San Jose scale, 5 per cent. This percentage is based on the assumption that all spraying-oil is 100 per cent. concentration, but in reality this is never the case, consequently consideration must be given to the dilution required. For instance, if the bulk spraying-oil is 80 per cent. oil and a 3 per cent. concentration is desired, 3¾ gallons will be required to make 100 gallons of spray.

To ensure a perfect emulsion, soft water must be used for mixing Hard water may be softened by the addition of washing-soda at the rate of from 1 lb. to 2 lb. per 100 gallons water. Extremely hard water often requires the addition of a little extra washing-soda to ensure a satisfactory emulsion being obtained. The necessary quantity of spraying-oil (say, 10 gallons) should be measured into a clean container for mixing, and the same quantity of water (10 gallons) poured slowly into the oil, the worker stirring thoroughly while the water is being added. The result, provided the necessary details are attended to, will be a milk-like solution, with no free oil in evidence. The balance of the water (80 gallons) may then be added slowly while the mixture is kept well stirred. This is a contact spray, and kills by asphyxiation the pest for which it is applied. When applying the spray the operator must be thorough, as all pests or their eggs not covered by the solution will survive and subsequently increase in numbers. Furthermore, the spray must be applied with sufficient force to drive it into all corners, crevices, and under loose bark, for it is in such places that many of the pests and their eggs or both are to be found during the dormant season.

Miscellaneous.

Pruning now should be pushed on with the utmost vigour, so that it may be completed before growth commences and so that growers may proceed with other essential work in due season. Prunings should be gathered and burned before bud movement, and large cuts painted with tar.

Spraying-outfits should be given their annual overhaul as early as possible to ensure that there will be no delay when the time arrives to make the first spray application. The hose should also be tested under full pressure at the first opportunity to allow ample time for procuring new hose if such should be found necessary.

Where phosphatic or potassic fertilizers are to be applied, these should be ploughed in now at the deepest ploughing of the year. Further delay in this operation appreciably lessens the beneficial effect of the fertilizers during the coming growing season.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

The principal work in citrus orchards during the next few months will consist of harvesting the fruit as it becomes ready. In order to obtain the best results this should receive attention each month, as steady supplies of fruit of good quality is an essential feature of all successful marketing operations.

The demand for oversized, coarse, tree-ripened fruit does not warrant its production, and such fruit can be avoided by harvesting at regular intervals. As there is a demand for fruit for peel, all fruit inclined to be coarse and oversized should be allowed to remain on the trees, and later disposed of to the factory for peel or juice purposes. This fruit should never be offered for sale in the open market. It should not be necessary to point out the necessity for offering for sale nothing but the very best fruit, of medium size, smooth in the skin, and practically free from blemish and disease. It is only by doing this that the demand for our locally-grown lemon will increase.

Every care should be exercised when handling the fruit, and this care should commence with the gathering and continue right along until the fruit is despatched to the consumer. Any skin-punctures provide a home for some of the rot-producing fungi, through which losses occur.

The fruit should be gathered when it has reached approximately the sizes that pack from about a hundred and fifty to two hundred lemons to the bushel case, irrespective of whether they are green, silver, or yellow, as these sizes are the most popular with the retailer and the consumer.

Whether growers should handle their own fruit and prepare it for the market after picking is a matter that can best be determined by the grower himself, having duly considered all the factors and the outlay necessary in order to colour, cure, and generally prepare the fruit in a manner that reflects credit upon the industry.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

The Hatching Season.

If young stock are to make the best development, to lay during the season of dear eggs, and to make the most suitable breeding-stock later on it is advisable that hatching-operations should take place during the next two months, or early in October at the latest. Those poultry-keepers who require only a small number of young stock of the Leghorn or light breeds will find that hatching at the end of September gives very satisfactory results. Heavy breeds, however, do better if hatched out in August. Where a large number of Leghorn pullets are required, and it is not possible to get them all hatched during September, it is much better to get them hatched during August and September than during September and October. The aim should be to hatch out the chickens neither too early nor too late, but it is better to have them a little too early than too late. There is always a risk of the August-hatched birds going into a moult during the late summer or early autumn, but late-hatched stock never make the same development; they generally lay small eggs, and these during the cheap season, thus returning very little, if any, profit over the cost of their feed.

The most popular system of breeding is to mate good selected second-season hens with well-developed cockerels which have been bred from proved parents.

Though some cock birds, even in their third and fourth years, have been known to have wonderful fertility, cock birds, as a rule, cannot be depended upon, especially early in the season, to give a high percentage of fertile eggs. Where, however, an exceptionally vigorous cock bird that has produced good stock is to be found he is a valuable asset to any plant, and should be mated specially to a few selected hens. Further, the cockerels produced from such a mating should be marked and used to head next season's breeding-pen.

If the breeding-stock are in good breeding-condition the eggs should prove fertile from five to seven days after the birds have been mated, and

usually remain fertile from seven to nine days after the male has been removed from the pen. The writer does not know of any way of controlling the sex or of telling which eggs will produce cockerels or which will produce pullets. No doubt some hens lay eggs which produce more cockerels than pullets, or *vice versa.* At times if a very vigorous cockerel is mated with a few hens early in the season more cockerels may be the result, but, taking the season right through, one can generally depend upon equal numbers of each sex from most flocks.

Eggs for Hatching.

Eggs intended for incubation, whether they are to be hatched in the natural way or placed in incubators, should be selected with great care. The aim should be to rear pullets that produce eggs of a good, uniform shape, size, colour, and texture of shell, and the only way to bring this satisfactory result about is to set only eggs of a good uniform shape, size, and colour. Those with thin, porous shells should not be used, as they seldom hatch and are easily broken. It is often an indication that the bird was not in a desired physical condition when such eggs were produced and that there is a weakness which is likely to be passed on to her progeny.

Rough-shelled eggs or those with ridges are generally unsuitable—the latter are often a sign that the hen which laid them is in an over-fat condition.

While it is true that very large eggs do not hatch well, it is not to be inferred that small eggs should be used for hatching purposes, for usually the small egg produces a small bird, which in turn lays undersized eggs. No eggs under 2 oz. in weight should be set. It is well to pay attention to the colour of the shell and only set eggs with that colour of shell you desire your birds to lay. For example, Leghorns (if purebred) should lay eggs with white shells, but sometimes individual birds in a flock lay eggs with shells of various shades of colour, varying from a cream to a light brown. On the other hand, eggs of the heavier breeds, such as Orpingtons, should be a dark-brown colour, although at times eggs with a more or less white or pale shell may be produced. Most of these defects can be corrected and birds bred that produce a good uniform class of egg if careful selection is made when saving eggs for incubation purposes, but this selection must continue year after year, for great improvement cannot be effected in a single year.

Eggs should be set as fresh as possible, for those that are over ten days old seldom give satisfactory results. When holding them for incubating-purposes they should be kept where the temperature does not fluctuate too much. A temperature of between 50° and 60° F. will be found most suitable, and if the eggs are held for any length of time it is advisable to change their position each day in order to prevent the yolk settling down to the side.

Period of Incubation.

Eggs from different classes of feathered stock take different periods to hatch out, as will be seen by the following: hen-eggs, twenty-one days; ordinary duck-eggs, twenty-eight days; Muscovy duck-eggs, thirty-five days; turkey eggs, thirty-five days; goose-eggs, twenty-eight to thirty days; guinea-fowl eggs, about twenty-six days; and pheasant-eggs, twenty-four days.

Artificial Incubation.

There is little doubt that the incubator is not yet made that is the best when worked in the same manner in all climates. In other words, owing to the many different classes of machines in use, the different localities in which they are operated, and the different classes of eggs used for incubation purposes, it is impossible, or at least very unwise, to attempt to lay down a set of hard-and-fast rules to be followed in order to get the best results

under all conditions. The results from artificial incubation depend largely on the fertility and vitality of the eggs, efficiency of the incubator, handling and working of the machine, and other circumstances. In the first place, the egg must be suitable, for if the embryo springs from a weak germ it will not live long. On the other hand, if the germ is strong and the egg lacks vitality the embryo cannot continue to grow. It is quite possible for eggs to be 90 per cent. fertile yet so lacking in vitality that very few hatch, or, again, the egg may be all that is desired, but if improperly incubated it is impossible to produce a good, strong chick. In order to get eggs suitable for incubation the breeding-birds must be selected carefully, fed and managed correctly, and the eggs set as fresh as possible

When selecting an incubator it is well to choose, if possible, a make that has been known to serve well in the locality. It is very seldom an economy to purchase a cheap or second-hand machine of unknown quality. Many cases of heavy losses and much disappointment are caused through poultry-keepers starting off with poor, second-hand machines. It is not the cost of the incubator that counts so much, but the cost of the eggs that are placed therein and the results obtained. The handling or working of the machine is an important factor, and in this connection it always is wise to follow the maker's instructions to the letter, and then if results do not come up to expectations it is advisable to consult a poultry-keeper in your own district who is working a similar make of machine. He usually is pleased to advise, and very often some slight alteration in the ventilation or the supply of moisture makes all the difference. The machine should be operated in a well-ventilated room, free from mustiness or kerosene fumes, &c., and not subject to much variation of temperature. Lamps when burning use a large amount of oxygen, and as the developing embryo also requires oxygen it is well to allow plenty of fresh air in the incubator-room, but to avoid draughts, especially near the lamps. A little extra ventilation about 3 in. or 4 in. from the floor in some incubator-houses helps considerably towards better results. If, the first time one enters the incubator-room in the morning, a strong smell of kerosene-fumes is noticed, it is well to arrange for a little more ventilation in order to keep the atmosphere fresh and sweet.

The amount of ventilation necessary depends on the class and number of machines being operated and on the size of the room. For instance, a lean-to room 15 ft. deep by 12 ft. wide, in which one 500-egg machine was operated, gave much better results when four 9 in. by 4 in. ventilators were placed about 3 in. above the floor-level, and four of a similar size were made at the ceiling-level.

Further notes regarding artificial incubation will appear next month.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Starting Beekeeping : Hints for Beginners.

THE spring is the best season of the year for starting beekeeping, especially for the beginner who is unacquainted with the practical care of bees. The time is therefore at hand when arrangements should be made for the purchase of bees and equipment. If the bees are obtainable locally the prospective beekeepers can make arrangements for the purchase of established colonies or can wait until swarming-time, when swarms are available. Perhaps the most satisfactory way is to purchase some established colonies from a neighbouring beekeeper and move them home before too much brood is present in the hives. No harm comes to bees moved in the colder months, the same provision for screening not being so essential as when moved

during the summer months. Screening the hives top and bottom is not necessary if the bees are moved only a short distance, and if the beekeeper takes the precaution of tacking a piece of wire gauze across the front entrance this prevents suffocation and makes for safe handling in transit.

The beginner is well advised to procure only strong, healthy colonies from a reliable beekeeper who can furnish a guarantee that the bees are healthy. Upon this depends much of his future success. The keystone to this condition is the permit issued by an Apiary Inspector under the Apiaries Act. The first question to be asked by the beginner of the seller is, "Have you the necessary permit to sell?" If this is forthcoming, the purchaser may rest assured that he has a reasonable chance of getting clean bees, apart from any of the other conditions which go to make a good hive. Although the purchase of first-class colonies is probably the most expensive way to commence beekeeping it has the advantage that such colonies are more easily kept in order than colonies which have been neglected and which require to have corrected the faults of the previous owner who has not learned to make his beekeeping profitable.

Since it cannot be expected that the beginner should know what constitutes a good colony, he should deal only with a beekeeper of some standing. With bees everything depends upon starting right. The possession of a colony in prime working-condition gives the beekeeper a standard with which to compare other colonies and enables him to avoid costly mistakes in their management. If the cost of starting a small apiary has to be considered, the beginner will find it an advantage to arrange for the purchase of as many first swarms as are wanted. These may be obtained in boxes and subsequently transferred to frame hives. Only early and prime swarms should be stipulated for, otherwise they will not build up in time for a crop.

The hives when placed in their permanent position should be sheltered and face the north Protection from cold winds is important, but the hives should not be placed under trees, as this has a tendency to make the bees vicious. The hives should be set on four bricks, as this allows for a free circulation of air under the bottom-boards, which rot if placed directly on the ground. The hives require to be level crosswise and have a slight cant lengthwise. This prevents driving rains from lodging within the hives: such lodging is likely to render the combs mouldy A watertight roof and sound bottom-board are just as essential to the welfare of bees as are good floors and roofs in human dwellings.

A certain amount of working-equipment is necessary. However, if provision is made for a smoker, bee-veil, hive-tool, and a pair of gloves, such other articles can be added as they are needed. Until such time as the beginner has become used to the stings he will find it an advantage to wear gloves, although he should accustom himself to do without them. In the course of time gloves become impregnated with poison, and this will irritate one's flesh on hot days; moreover, it is resented by the bees. There is much difference in the temper of bees: blacks are much more troublesome to handle than Italians, but with a little care in carrying out hive-manipulations and the free use of smoke most colonies can be handled with very few stings.

At all times when handling bees the beginner should be prepared to complete the work and not allow himself to be driven from the hives. By the "free use of smoke" it is not meant that the bees should receive an overdose, as this may demoralize them and render them liable to attack from other colonies. Moreover, it does not bring them under control, but tends to aggravate them. It has the further disadvantage that as the bees are driven from the combs they form in clusters on the bottoms of the frames and the sides of the hives, making it well-nigh impossible to locate the queen and to carry out other essential work with any degree of success.

Suitable fuel for the smoker is dry, clean sacking, no other material being as good. Avoid oily waste and cotton materials, as the smoke from these

articles makes the bees vicious. When starting to manipulate a hive puff a little more smoke in at the entrance, and having removed the roof, puff a little more smoke on the frames as the mat is peeled off. This operation being complete, the frame nearest to the operator can be taken out, allowing of the prizing-apart of the remainder of the frames preparatory to making a complete examination of the whole. When handling bees all operations are best carried out in a gentle manner, avoiding at all times quick movements and clumsy manipulations which may crush them. It must be remembered that nothing irritates bees more than the odour of the poison which fills the air when bees are crushed.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Effective and Economical Use of Fertilizers.

INTENSIVE production of crops of fruit, vegetables, and flowers require considerable supplies of fertilizers, and the measure of success obtained depends very largely on the consideration given to their use. The demand for definite information on the subject is inclined to standardize the practice, but this has very decided limitation. Some growers of a generous disposition apply very heavy dressings, regarding it as a sound policy to keep the ground in high condition. This policy is often wasteful and sometimes injurious to the crops.

Manuring is a subject in which there is no finality and constantly requires the most careful consideration of the cultivator if the best results are to be obtained. The chief factors to be considered are the requirements of the crop about to be planted, the condition of the land at the moment, and the weather. Applications of fertilizers after the crop is established require special care. The crop may be soft and rank owing to weather conditions experienced and require hardening by an application of potash, or, if flowers and fruit or seed are required, an application of phosphates to encourage that development. It is then advisable to apply too little rather than too much, as it is better to repeat the application than have to deal with the effects of an over-dose.

The usual requirements of crops in order of importance may be stated as follows,—

(1) Turnips, carrots, beetroot, parsnips, radishes, peas, beans, melons, marrows, pumpkins, cucumbers, tomatoes: Phosphates, potash, and nitrogen.

(2) Potatoes, onions, leeks, artichokes, shallots: Potash, phosphates, and nitrogen. This does not mean that more potash than phosphates should be applied, but a maximum application of potash, about 2 cwt., and an amount of phosphates less than the maximum, which is about 10 cwt., per acre.

(3) Cabbage, spinach, celery, asparagus, cauliflower, rhubarb: Nitrogen, phosphates, and potash.

Onions and leeks are benefited by a greater amount of nitrogen than others with which they are bracketed; and asparagus, also, on the land on which it is usually grown, with more potash.

To supply these requirements economically and effectively in the form of artificial fertilizers it is necessary carefully to form an estimate of what plant-foods are already present in the land, the estimate being chiefly based on the quality of the land, the behaviour of recent crops, and consideration of residue of previous applications. Land of good quality recently broken in from pasture should produce any of the above-mentioned crops satisfactorily if a suitable dressing of only phosphates is applied. Heavy land is usually well supplied with potash and is very retentive of any application that may be made; a good dressing of farm manure will probably supply

all the requirements of crops listed in class (3), with the exception of phosphates; after which it should carry any of the crops listed in classes (1) and (2) with a similar dressing.

Usually the latter crops are grown on a medium well-drained loam for early cropping—land which is less retentive and assimilates humus with considerable rapidity. Like the light soils, it is more or less "hungry" but "early," and it is here that the effective use of fertilizers is a fine art. Such land must be constantly supplied with humus and fertilizers applied "little and often." With a good water-supply such land may be very productive. For annual crops sown with rows fairly close and requiring a moderate dressing the fertilizers may be broadcasted and worked in during the preparation of the land; but for crops such as outdoor tomatoes that are planted with a considerable distance between rows and require a fairly heavy dressing, the first application of fertilizers may be drilled along the line of planting; and, after planting and establishment, further dressing may be made between the rows as required and cultivated in. Where heavy dressings of fertilizers are applied, difficulties are frequently met when using nitrogen in the form of sulphate of ammonia and nitrate of soda: the tilth of the soil may be injured with serious consequence where fine seeds are sown and humus is scarce. This is particularly bad where nitrate of soda is constantly used on heavy land. The fertilizer is alkaline and the tilth is destroyed by the carbonate of soda deflocculating the clay particles. An acid manure, such as superphosphate or sulphate of ammonia, will improve the condition. Where soil deteriorates through the use of sulphate of ammonia, as it may do on soil inclined to be acid, the remedy is to apply finely ground carbonate of lime. With due caution along these lines nitrogenous fertilizers may be used with best results. The nitrate of soda being immediately available to the plants is of special value in the spring, when the temperatures are too low for the active production of nitrates by natural bacterial processes in the soil. By carefully studying his land and its reactions to fertilizers and crop one should gradually build up an experience which will enable the land to be kept in good heart and satisfactory crops to be obtained at an economical cost.

Vegetable Crops.

When the soil is dry and friable the opportunity should be taken promptly to prepare the ground for sowing and planting. In fine weather it is advisable to hoe growing crops to destroy weeds and to apply a light dressing of nitrate of soda to accelerate the growth of spring cabbage, lettuce, and other crops of the kind. It is unsafe, in most districts, to leave after the end of August parsnips and other root-crops which have been allowed to remain in the ground over winter. It is well to lift them when the ground is dry and store where the conditions are cool and humid.

Early crops, and hardy crops requiring a long growing season, should be planted so soon as land and temperatures permit. In fine weather, after the land has been throughly prepared, plant autumn-sown onions, shallots, rhubarb, early potatoes, artichokes, and asparagus. And sow parsnips, short-horn carrots, globe beet, turnips, radishes, broad beans, early peas, lettuce, spinach, parsley, cabbage, and cauliflower; also asparagus where roots are required for planting out twelve months hence.

To obtain good crops, good land and culture alone are not sufficient. It is important that the seeds should be sound and of good strain and variety. The successful grower always is on the look-out to obtain the best in this respect. Caution is specially necessary when selecting seed potatoes and asparagus. The Government system of seed certification is of great assistance in obtaining satisfaction as regards the former. Growers of early potatoes in warm localities should obtain fresh stocks of certified seed annually or at the longest every two or three years. In many instances the best asparagus-seed will be obtained by marking the

best plants in a good crop in the locality and allowing the plants to ripen the seed in advance of the rest of the bed. As asparagus-seed is slow in germinating it may be soaked in warm water for twenty-four hours and dried off with a little lime, which will help to regulate the planting. A few radish-seed added will germinate quickly and indicate the rows so that weed-control may not be delayed

Half-hardy crops for planting out early in the month of November should be started on a hot-bed towards the end of August. They include tomatoes, egg-plants, peppers, melons, and cucumbers. Self-blanching celery may be included in this sowing. When established after pricking out it is advisable to ventilate freely in fine weather to produce sturdy plants. The heat in a hot-bed is obtained by fermenting fresh stable manure, which may be supplemented by leaves of deciduous trees, where obtainable. To produce a uniform state of fermentation the material is stacked in a compact heap, and, when fermentation is established actively, turned, mixed, and restacked, any dry portions being moistened from a watering-can in the process. It will probably require to be turned two or three times in this way before it is in an active state of fermentation throughout the whole mass; but time and care in its preparation is amply rewarded by the superior results obtained.

Where tomato crops under glass are to be planted out reference may be made to suggestions printed in the July copy of the *Journal*. Where this operation has already been carried out the chief consideration needs to be given to the matter of ventilation and of maintaining a satisfactory temperature at night. The plants must be kept growing steadily. A close atmosphere and soft rapid growth ultimately lead to disappointment; on the other hand, over-ventilation, especially when a cold wind is blowing, seriously checks the crop. Close attention during the changeable weather experienced at this season is necessary to maintain good growing conditions under glass at all times. Generally early ventilation in the morning on fine days, and closing down the ventilators about the middle of the afternoon, so as to retain a desirable amount of sun heat, are the main features of the programme. A sharp look-out should be kept for green aphis, at the first sign of which it is advisable to fumigate with nicotine sulphate 1 fluid ounce to 1,000 cubic feet of space. The liquid should be vaporized by placing it in open tins over spirit-lamps. To disseminate the fumes as quickly as possible vaporizing should be done in a number of places about the floor of the house. An evening without wind and the house tightly closed are the most desirable conditions.

For the tomato crop outside, in addition to raising good plants, consideration must now be given to the preparation of the land. In many instances the land may be carrying spring cabbage or salad crops, but careful consideration should be given and arrangements made to take it in hand as soon as it is available so that the preparation may be completed in good time for planting the early crop.

Small Fruits.

New plantations of hardy fruits should be made as soon as possible, and the plants carefully pruned as described in the June number of this *Journal*. The more tender crops, such as passion-vines and Cape gooseberries, may be left for planting later when temperatures are warmer.

Unless it has already been done, established crops should be given a dressing of fertilizers, principally phosphates and potash, followed by a dressing of nitrogenous manure as they come into flower.

To control leaf-spot and other fungous diseases to which these crops are susceptible a thorough application of Bordeaux 3–4–40 should be made shortly before growth commences. As an alternative, ½ pint of lime-sulphur diluted with four gallons of water may be used. This latter spray is also

a good remedy for rose-scale, which is frequently found attacking raspberry plantations. The application should be repeated at intervals of two or three weeks, as may be necessary.

The Homestead Garden.

As the planting season for hardwood plants closes about the end of the month of September advantage should be taken of intervals when the weather is fine and the soil dry to complete work of this kind. Hardy herbaceous borders may also be planted, and the sooner new lawns are completed, especially in the drier districts, the better will be the chance of rapid and satisfactory establishment. Gravelling walks and returfing broken verges will also add much to the appearance and comfort of the homestead garden.

During the month of August sweet peas and other hardy annuals may be sown outside, and towards the end of the month half-hardy annuals in boxes on a hot-bed for planting out when spring frosts have finished.

Rose-pruning should now be completed. Varieties of most kinds flower on the new wood, which is produced best on good wood of the previous season. For this reason weak and old wood may be discarded, except such as may be required for furnishing the plant. If the plants are afterwards sprayed with lime sulphur it will do much towards the control of fungous disease and the scale blight to which roses are susceptible.

—*W. C. Hyde, Horticulturist, Wellington.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from the 13th June, 1935, to 27th June, 1935, include the following of agricultural interest :—

No. 72819: Plough; J. A. Thomson No 73606: Deburring skins; O. Stone and T. S Bull. No. 73827: Butter-churning (*Cognate with* No. 72919 below). No. 72086: Cheese-crate; A. St C. Hill. No. 72919: Butter-churning; Vacu Churns, Ltd. No. 73741: Active humus; N. V. Octrooien Maatschappij "Activit." No. 73814: Fruit-crate; G. Strachan No. 73828: Animal-trap; W. L. Ure. No. 73831: Nutrient material; British Arkady Co, Ltd. No. 73844: Meat-roll; H. Vickers No. 73856: Cream preparation: S. H Hartmann. No. 73867: Seed-planting; A McWatters, jun. No. 73869: Garden tool; The Interchangeable Garden Tool Co., Ltd. No. 73877: Meat-protein preparation; Chappel Bros.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

In pursuance of section 3 of the Poultry-runs Registration Act, 1933, Mr. Walter Horrobin has been appointed a Government representative on the New Zealand Poultry Board.

The Role of Soil Analysis.—It has become possible to take up once more the important question of soil analysis. Nothing in agricultural science has had a more chequered career. Hailed at the outset as a great scientific triumph, it had to be abandoned because its results were so often useless to the farmer. It is now recognized that two distinct problems are involved: Soil analysis for advice in regard to manuring, and soil analysis for the characterization of soils for purposes of soil surveys. Two groups of methods are therefore needed, and these are being worked out in the Chemical and Physical Departments.—*Rothamsted Report for 1933.*

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION TO 30TH JUNE, 1935.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list comprises those crops passed up to 30th June. Further lists will be published in later issues.

In the May *Journal* was published a list of growers who had received provisional certificates. The acreage, percentage of foreign varieties present, and the classification and group number representing the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—

Adams Bros., Sheffield (Line A).
Adams Bros., Sheffield (Line B).
Hegan, J., and Son, Southbrook (Line B).
Kenyon, F., Mina, North Canterbury (Line B).
Oakley, J. T., Eiffelton, R.M.D. (Line A).
Oakley, J. T., Eiffelton, R.M.D. (Line B).
Oakley, W., Halkett, R.M.D. (Line A).
Oakley, W., Halkett, R.M.D. (Line B).
Overton, H. M., Lakeside.
Redmond, C., Kimberley, R.M.D.
Smith, E. A., Springston, R.M.D. (Line A).
Westaway, R. J., Courtenay, R.M.D.
Wright, L. T., Annat.

Commercial Seed—

Ballantyne's Estate, Fairview, Timaru.
Gray, J. L., St Andrew's (Line C).
Kelleher, T., Pleasant Point, South Canterbury (Line B).
Rich, A. J., Kaiapoi, R.M.D.
Ross, A., Washdyke, Timaru (Line A).
Ross, A., Washdyke, Timaru (Line B).
Steven, G. H., Rosewill, Timaru.
Weeber, H., Englefield Road, Belfast (Line C).

DAKOTA.

Mother Seed—

Ryan, P. F., Weedon's, R.M.D.

Commercial Seed—

Steven, G. H., Rosewill, Timaru.

ARRAN CHIEF.

Mother Seed—

Robinson, R. G., Ltd., Box 4, Papanui, Christchurch (Line A).
Wright, L. T., Annat.

Commercial Seed—

Bruce, J. A., Otahuti, R.M.D.
Oliver, J. O. J., Factory Road, Temuka.
Topham, J. W., Arowhenua, Temuka (Line C).

ARRAN BANNER.

Mother Seed—

Burgess, D., West Plains, Invercargill.
Knowler, H., Te Waewae.
Milburn, M., Wright's Bush, R.M.D., Invercargill.
Wright, L. T., Annat.

Commercial Seed—

Barnes, W., and Son, 199 Highsted Road, Styx.
Craig, G. H., Mosgiel (Line A).
Craig, G. H., Mosgiel (Line B).
Oakley, W., Halkett, R.M.D.

KING EDWARD.

Mother Seed—

Burgess, D., West Plains, Invercargill.
Kokay, S., Tuatapere.
Milburn, M., Wright's Bush, R.M.D., Invercargill.
Miller, R., East Taieri.

Commercial Seed—

Bruce, J. A., Otahuti, R.M.D.
Craig, G. H., Factory Road, Mosgiel.
Graham, J. W., Factory Road, Mosgiel (Line A).
Graham, J. W., Factory Road, Mosgiel (Line B).
Graham, J. W., Factory Road, Mosgiel (Line C).
Penn, T. A., 154 Innes Road, Christchurch.

EARLY ROSE.

Mother Seed—

Shellock, W., Te Pirita, R.M.D., Rakaia.
Weaver, J., care of A. Weaver, Te Pirita, R.M.D., Rakaia.

EPICURE.

Mother Seed—

Shellock, W., Te Pirita, R.M.D., Rakaia.

Commercial Seed—

Campbell, D., King Street, Rangiora (Line B).

JERSEY BENNES.

Mother Seed—

Burgess, D., West Plains, Invercargill.

Milburn, M., Wright's Bush, R.M.D., Invercargill.

MAJESTIC.

Mother Seed—

Oakley, J. T., Eiffelton, R.M.D.

EARLY REGENT BOLTER.

Mother Seed—

Oakley, W., Halkett, R.M.D.

Commercial Seed—

Oakley, J. T., Eiffelton, R.M.D.

IRON DUKE.

Commercial Seed—

Penn, T. A., 154 Innes Road, Christchurch.

SIR J G. WILSON.

Mother Seed—

Robinson, R. G., Ltd., Box 4, Papanui, Christchurch.

—*Fields Division.*

The yield of citrus fruits in the Dominion is gradually increasing, and in this connection it may be noted that the Poorman orange is increasing in popularity and coming into use as a good substitute for imported grape-fruit. The production of lemons is excellent as regards quantity, but the marketable quality of many of these home-grown lemons is greatly depreciated through failure to subject them to a proper grading and curing process. If all our lemons were properly graded and cured there would be little need for importations of this fruit. -*Report, Director-General of Agriculture.*

WEATHER RECORDS: JUNE, 1935.

Dominion Meteorological Office.

NOTES FOR JUNE.

JUNE was remarkable for several severe storms, which were responsible for prolonged and strong winds between westerly and south-westerly and for frequent wet days. Owing, however, to lack of extreme temperatures, in most districts there was some growth in pasture, and stock generally continued in good condition This was especially the case in much of the North Island, where an absence of hard frosts and periods of mild temperature induced an abnormal growth of grass for the time of the year.

Rainfall.—The aggregate rainfall was below the average in a small area about Cook Strait and parts of the western districts of the South Island, while the remainder of the Dominion recorded above normal.

Temperatures.—Temperatures were above the average over most of the North Island, the difference being greatest in the Taranaki and Auckland districts. In the South Island they were below, except in the extreme north and parts of Central Otago.

Sunshine.—As might be expected from the large number of wet days experienced, sunshine was nearly everywhere below the mean, the only districts where it was above being Marlborough and Otago

Storm Systems.—The month began with fine weather, which lasted until the 4th, while an anticyclone was moving across New Zealand.

On the 5th and 6th a cyclone moved from the north, passing off East Cape during the night of the latter date Heavy rain was associated with this disturbance between Hawke's Bay and East Cape and some flooding occurred. Dull, misty conditions prevailed generally, but rainfall was only light and scattered in the South Island. There was a fairly general improvement in the weather on the 7th, but from the 8th to the 12th a series of deep westerly depressions crossed the Tasman Sea and New Zealand. Consequently, strong north-west to south-west winds and boisterous conditions were experienced in most districts. During the night of the 9th, while a secondary low centre was crossing the South Island, much of the South Island and some of the high country in the North Island experienced a fall of snow. There were other but lighter falls of snow on the 11th and 12th, and on the latter date a bitterly cold south-westerly wind swept over the Dominion accompanied by hail in places. During the evening of the 12th, however, the weather rapidly cleared and some severe frosts were recorded in the night, Christchurch having one of 13·8 degrees. The last portion of this series of depressions had, by then, passed eastwards, and several days' fair to fine weather followed.

By the evening of the 16th a fresh depression had moved on to the Dominion, and until it had passed away eastwards on the 20th cloudy and squally weather prevailed over most of the country with intermittent and, in places, heavy rain. Otago experienced particularly heavy southerly rains on the 18th, and there was considerable flooding in low-lying areas. By the morning of the 19th a general change to southerly winds had taken place, and cold southerlies continued throughout the 20th, with showers in most districts and hail on parts of the coast.

An anticyclone covered the Dominion on the 20th, and the weather was brilliantly fine almost generally. The former, however, moved rapidly eastwards and was followed by a further series of deep depressions, which continued to cross the country until the close of the month. Consequently, strong westerly to south-westerly winds prevailed. In eastern areas during this period precipitation was mainly light and scattered, but districts with a westerly aspect and the central areas of the North Island experienced persistent rain and some of their heaviest falls.

RAINFALL FOR JUNE, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	4·60	25	0·42	6·59	32·99	28·16
Russell	8·08	22	2·50	6·49	53·62	27·33
Whangarei	10·76	25	2·00	6·54	43·12	31·60
Auckland	7·02	27	0·87	5·44	32·57	24·28
Hamilton	7·21	24	1·15	5·11	24·20	23·90
Rotorua	10·16	20	1·90	5·25	38·60	26·87
Kawhia*	..	..	..	5·72	.	25·54
New Plymouth ..	7·82	23	0·95	5·95	41·91	28·54
Riversdale, Inglewood ..	13·45	24	1·70	10·27	65·68	48·65
Whangamomona ..	10·54	18	1·45	7·89	49·04	35·70
Hawera	7·92	23	1·30	4·41	33·91	21·39
Tairua	7·71	25	1·51	6·97	40·49	33·56
Tauranga	8·25	23	1·25	5·35	36·16	26·88
Maraehako Station, Opotiki	9·87	17	2·98	5·66	45·90	27·79
Gisborne	6·91	15	1·95	4·90	24·97	24·91
Taupo	7·13	17	1·29	4·56	29·60	21·36
Napier	7·71	18	3·66	2·92	27·12	16·08
Hastings	5·49	16	2·75	3·07	21·50	16·63
Whakarara Station ..	8·11	19	3·22	..	32·85	..
Taihape	4·35	21	0·93	3·38	20·33	17·81
Masterton	4·11	20	0·65	3·59	18·26	18·77
Patea	7·21	18	1·47	4·24	31·55	21·40
Wanganui	4·37	18	0·77	3·37	24·01	17·70
Foxton	4·59	15	0·70	3·39	19·11	15·27
Wellington	2·80	16	0·60	4·31	17·15	20·89
South Island						
Westport	9·24	22	1·23	8·85	49·05	46·50
Greymouth	8·55	19	1·48	8·80	55·95	49·56
Hokitika	8·74	20	2·69	9·22	68·26	55·09
Ross	8·69	17	1·68	8·73	66·13	62·77
Arthur's Pass ..	3·71	7	1·10	10·53	77·32	75·94
Okuru, South Westland	4·82	7	1·25	10·72	64·56	72·04
Collingwood	10·89	20	2·14	10·30	53·25	45·08
Nelson	3·51	17	1·32	3·51	24·82	18·32
Spring Creek, Blenheim	2·56	14	0·78	2·94	15·48	14·47
Seddon	0·92	8	0·26	2·09	9·51	12·32
Hanmer Springs ..	5·03	15	1·69	3·39	20·51	21·77
Highfield, Waiau ..	3·28	7	1·25	2·47	13·32	16·74
Gore Bay	2·87	11	0·62	2·69	11·57	15·87
Christchurch	3·22	9	1·17	2·53	11·66	12·63
Timaru	3·27	10	1·07	1·75	12·61	11·14
Lambrook Station Fairlie	3·78	7	1·94	1·86	13·85	11·98
Benmore Station, Clearburn	0·85	12	0·27	1·81	13·28	12·80
Oamaru	2·20	9	1·61	1·98	11·72	10·98
Queenstown	2·69	11	0·64	2·22	19·92	15·35
Clyde	2·47	6	1·15	0·92	10·69	7·76
Dunedin	5·89	17	3·72	3·14	22·63	18·08
Wendon	4·92	15	1·52	2·59	22·52	15·48
Balclutha	5·26	11	2·14	1·99	20·52	12·71
Invercargill	7·38	23	1·00	3·64	31·18	23·31
Puysegur Point ..	9·44	22	1·34	6·59	47·73	42·26
Half-moon Bay ..	6·75	22	1·03	4·91	31·52	29·13

* Observer died.

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EXPERIMENTS ON THE CONTROL OF PINK COB-ROT OF MAIZE.

J. C. NEILL and R. M. BRIEN, Mycological Laboratory, Plant Research Station, Palmerston North.

A DRY-ROT disease of maize-cobs has caused severe crop losses from time to time in the Poverty Bay and Bay of Plenty districts. During the 1932–33 season it was particularly prevalent and gave cause for grave concern to growers. It again appeared in the 1933–34 crops, but not to any increased extent. Very few signs of the disease have been observed during the current exceptionally dry season, 1934–35.

APPEARANCE OF THE DISEASE.

Affected cobs are light in weight and have a dry, unhealthy appearance. Between and over the kernels appears a white to pink weft of fungus-strands extending from the silk end towards the base of the cob. The kernels are dry, shrunken, light in weight, somewhat loose in their sockets, and, in cases of early infection, may be largely missing from the silk end. The sheath may be discoloured and partly cemented to the cob by fungus-strands.

In the seedling stage the fungus attacks both the shoot and the root. If the seed is infected severely this attack takes place simultaneously with germination, and the seedling dies before emergence. In most cases, however, the seedling has pushed well above soil-level before complete decay of the primary root and lower part of the shoot has taken place. Secondary roots are then pushed out near the surface-level and these take up the work of nourishing the growing plant. These secondary roots seldom show signs of infection, and the plant thereafter develops apparently free from the disease.

CAUSAL ORGANISM.

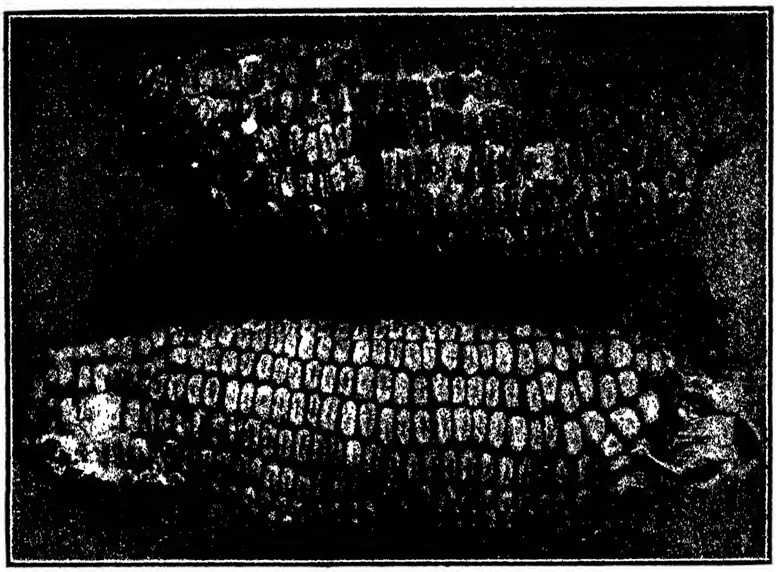
Cultures from diseased cobs have constantly yielded the fungus *Fusarium moniliforme* Sheld. var. *subglutinans* Reink. and Wollenw.* *Fusarium moniliforme* has been reported from most countries as causing a pink cob-root and seedling-mortality of maize. The same species also occurs on a wide range of cereals and grasses, but ther[illegible]

* Cultures of the fungus so identified by S. F. Ashby, Imperial My[illegible]— Institute, Kew.

is no evidence to show whether or not the strain causing this disease is specific to maize. The question is of some importance as affecting control, since if maize is the only source of infection, then complete elimination of all remnants of previous crops should prevent re-infection of the new.

Summary of Literature.

A *Fusarium* cob-rot of maize, which is apparently identical with the disease dealt with in the present article, has been recorded in most maize-growing countries. Several workers have shown that diseased seed yields a less emergence of seedlings than healthy seed, but that, when once established, there is little difference between the plants.



PINK COB-ROT OF MAIZE.

[*Photo by H. Drake.*

Seed-treatments, especially with organic mercury dusts, generally show improvement in yield when used with heavily infected seed, and little or none with healthy seed. No direct connection has been traced between infected seed and diseased cobs, and it is generally held that infection of the latter is due to air-borne spores, which first attack the silk and then spread to the grain. The origin of this infection is frequently ascribed to remnants of previous crops, and control methods usually take the form of advice to collect and burn all such remnants, and to refrain from growing maize for two seasons on land which has carried an infected crop.

Experiments on Control.

-riments on disinfection were carried out on highly infected
 with hot water, and with organic mercury dusts and

steep. After treatment the seed was dried and samples sown in sterile sand in open trays, the resultant plants being pulled and examined for root lesions. Other samples were germinated on sterile filter pads in petri dishes, being examined for the appearance of the *Fusarium*.

Table of Results.

Treatment.	Number.					
	Sown.		Germinated.		Diseased.	
	Sand.	Pads.	Sand.	Pads.	Sand.	Pads.
Untreated control	100	20	92	15	70	20
Hot water, ten minutes at 125° . .	50	20	45	17	10	8
Hot water, ten minutes at 130° . .	50	20	43	16	6	8
Hot water, ten minutes at 135° . .	50	20	47	17	0	3
Hot water, ten minutes at 140° . .	50	20	45	19	0	0
Hot water, ten minutes at 145° . .	50	20	37	14	0	0
Organic mercury steeps—						
"Uspulun" 0·25 per cent, 1 hour. .	50	20	46	16	0	13
"Uspulun" 0·25 per cent, 2 hours	50	20	45	17	1	15
Dusts—						
"Agrosan G," 2 oz. per bushel . .	50	. .	45	. .	2	. .
"Ceresan New," 2 oz per bushel . .	50	. .	46	. .	0	. .

A third series of ten-minute hot-water treatments, put to germinate on sterile pads in petri dishes, ranging by 2° intervals from 134° to 150° showed complete disinfection of the seed at 138° and upwards, with no germination injury up to 142°, and thereafter a steady increase in injury up to 150°

Field trials on the effect of seed disinfection on the incidence of cob-rot were carried out at the Plant Research Station, Palmerston North, during the 1933-34 season. Two blocks of land (A and B) were used, one being sown with untreated and dusted seed, and the other with hot-water-treated seed only. These blocks were about two miles apart and neither had grown maize previously, nor was there any maize in the vicinity. The seed used was hand-shelled from cobs collected from an infected crop at Te Puke, Bay of Plenty. Sowing was done by hand, three seeds per hill, the hills being 3 ft. apart each way.

On Block A 280 hills were sown with seed dusted at the rate of 2 oz. per bushel with "Ceresan," 336 hills with seed dusted with "Agrosan G" at 2 oz. per bushel, 336 hills with seed from the same bulk untreated, and 198 hills with untreated seed taken from specially selected heavily *Fusarium*-infected cobs.

For Block B, all the seed was treated by a dip of ten minutes in water held at 143° F. This reduced the germination on filter pads from 94 per cent. to 79 per cent., the untreated seed showing 30 per cent. infection with *Fusarium* and the treated seed being apparently free from fungi. Part of this block was sown with hot-water-treated seed which had in addition a dust treatment of 2 oz. per bushel of "Ceresan," and part similarly dusted with "Agrosan G."

On Block A counts were made following germination of the number of hills in which the full number of plants had established, and at harvest the number of sound, of malformed, and of diseased cobs was recorded for each treatment.

On Block B no comparative germination counts were taken, on account of irregular seedling-damage caused by birds. At harvest plants from the "Ceresan" and "Agrosan G" treated seed were counted together for comparison with those from seed that had been hot-water-treated alone.

In both blocks the seedlings were thinned to not more than two per hill. Sowing took place on the 8th and 9th November, 1933, and harvest early in June, 1934.

Table of Results.

Treatment.	Total.		Percentage of Cobs.			Percentage of Hills with Full Germination.
	Hills.	Cobs.	Normal.	Malformed.	Diseased.	
Block A.						
Dusted "Ceresan" ..	280	776	55·0	40·5	4·5	73
Dusted "Agrosan G" ..	336	961	58·0	37·0	5·0	85
Untreated	336	985	54·0	40·6	5·4	66
Diseased seed untreated	168	417	48·6	46·0	5·4	17
Block B.						
Hot-water-treated ..	1,300	3,628	69·4	24·8	5·6	..
Hot water plus "Ceresan" and "Agrosan G" dusts	665	1,799	71·1	22·2	6·6	..

Summary of Results.

It was found that maize seed infected with *Fusarium moniliforme* could be disinfected with little injury to germination by a dip of ten minutes in water held at from 138° F. to 142° F. Plants from infected seed treated with organic mercury dusts and steep, grown in sterile sand, remained nearly free from root lesions when corresponding plants from untreated seed were severely affected.

In the field the amount of cob-rot which developed bore no relation to the degree of infection of the seed. Highly infected seed produced no more diseased cobs than lightly infected seed, and less than disinfected seed grown in another locality.

The field germination of highly infected seed was much below that of lightly infected seed, and was improved for the latter by dusting with organic mercury preparations.

Suggestions to Growers.

Since no reduction of cob-rot is to be expected from seed-disinfection, elimination of sources of air-borne infection, by the burning of all maize refuse and by crop rotation, offers the most feasible means of control. Organic mercury dusts ("Agrosan G" or "Ceresan"), at 2 oz. per bushel, largely control seedling mortality from the disease. This treatment costs about 5d. per bushel of seed, and can be carried out any time between harvest and sowing. Dusted seed keeps at well as undusted, and is safe from rodent or insect attack.

The dust and seed should be mixed thoroughly in a dust-tight container —mixing on a floor or in a sack is wasteful and inefficient. Particulars of the construction of a cheap home-made dusting-machine may be obtained from the makers of these dusts or from Instructors in Agriculture.

The writers desire to acknowledge with thanks the assistance given in this work by Mr. C. Walker, Instructor in Agriculture, Te Puke, who supplied the information herein contained on the field distribution and incidence of the disease, and also the diseased material used in the experiments.

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FARMING IN THE AUCKLAND PROVINCE.

OBSERVATIONS ON FARM-MANAGEMENT METHODS.

P. W. SMALLFIELD, Fields Superintendent, Auckland.

(Concluded.)

WHANGAREI COUNTY.

June 14th, 1934: Poroti to Puwera.—Inspected a settlement of gum-land farms at Poroti, and thence through the basic volcanic-soil areas of Whatitiri, Maungatapere, and Maunu, and up the Otaika Valley to the old Experimental Farm at Puwera. The gum-land at Poroti shows some interesting features, the soil being a mixture of clays and grey silts. On the silts, mature podsols, there is an impervious pan which prevents surface drainage. Parts of the land are hopelessly boggy in the winter and bake hard and dry in the summer. In its natural state the soil carries a surface-covering of rushes and umbrella fern. When grassed, without drainage, rye-grass and white clover often die, and the only plants to survive are paspalum and *Lotus major*. In the summer it seems that it would be impossible to drain this land owing to the hardness of the soil, but in winter, if drains are dug down to the hard pan, the water and air soon soften the cement-like pan, and the drain can be easily dug through to the clay beneath. The best drains for this sort of land are underground fascine drains made of manuka, which were so successfully used (by Patterson(4)) on similar land at the Puwera Experimental Farm. Long manuka, which is found growing in most of the valleys on gum land, is tied into bundles 6 in. or 8 in. in diameter and wedged into the bottom of a V-shaped drain. Surface drains are of no use—the actual water-table must be lowered by underground drainage.

The basic volcanic soil areas from Whatitiri through Maungatapere to Maunu made a welcome change of scenery to the grey undeveloped gum-land areas. Originally heavily forested, this volcanic country looks and is good land: with its rich green pastures, neat stone walls, and beautiful trees—principally groves of puriri. The basaltic-lava flows and scoria cones give rise to fertile soils—rich friable red or brown loams, commonly known as volcanic land. The only fault that they have is drying out badly in the summer. Before top-dressing was a common practice a good deal of the pasture on these soils was poor and contained a lot of ribgrass and brown-top: subterranean clover was, and still is, fairly common—quite a good indication of a soil that dries out badly in the summer Most of this volcanic land is devoted to dairying. The general butterfat-production per acre for the whole land farmed is not high, on account of most farms still having considerable areas of partly improved land that is covered in stones, fern, and poor grass.

Visited a dairy-farm on the volcanic land that I had not been on since 1928, when the farm was in the course of being broken in from a condition of rough stony pasture of ratstail, danthonia, and buffalo grass. The pastures, particularly the ones closed for winter feed, showed an excellent growth of grass Cocksfoot and rye-grass were growing splendidly—the cocksfoot growth especially caught my eye, as I had only the week before been up in the Rotorua District, where all the cocksfoot had been whitened by early winter frosts.

In sowing down this light volcanic land to grass, consolidation is just as important as on other classes of land. I recently saw a partial failure of grass on this land caused through the farmer trying to do things too well and yet omitting that very necessary consolidation of the seed-bed, without which a good establishment of grass and clover cannot be obtained. It was a field of light volcanic land which had been under annual crops for two or three years and on which the farmer desired to get a first-class rye-grass and white clover pasture. Thinking he would do the land particularly well, he sowed a crop of lupins and ploughed them in prior to sowing the grass. He omitted to consolidate the seed-bed properly and the strike of grass and clover was poor, and only round the gateways, where the land was consolidated by moving implements, was a good strike obtained. Now, the heavy clay land should be consolidated by allowing the land to settle: light land, on the other hand. wants to be consolidated with the Cambridge roller. To consolidate the bottom of the seed-bed the land should be rolled on the furrow after ploughing. The roller pushes the furrow slices together and firms the bottom of the seed-bed.

There is a good deal of gum-land development going on up the Otaika Valley—mostly Crown settlers established under the Land Laws Amendment Act, 1929. It was very interesting to see again some of the pastures on the Puwera Farm—good pastures of perennial rye, paspalum, and white clover on what was looked on originally as a hopeless soil. Water is short on most of this gum land, and stock have to be supplied in the summer from water held in the valleys by means of dams: this dam water is not good for stock, and bore water cannot be obtained.

I saw a team of six bullocks disking an area of ploughed gum land. It is curious how the old and new so often exist side by side in farming. It is generally considered that modern farm tractors are the last word in farm equipment, and yet here were bullocks doing excellent work, and probably cheaper work than could be done with horses or tractors. The argument as to whether bullocks or horses were the best for farm-cultivation work started in the Middle Ages and lasted down to the time of Arthur Young, who summarizes the chief point in favour of bullocks by stating "Ox teams are maintained in the winter at much less expense than horses." For small-scale breaking in of gum land there is much to be said in favour of using bullocks. Some time ago I visited a settlement on gum land where practically every horse the settlers started with had died. Certainly the horses were probably poor and old to start with, but some had died from poor feeding, some had broken their necks or got hopelessly bogged getting down to drink at water-holes. A favourite method of wintering stock on newly developed gum land is to turn them out on the unimproved gum-land hills which have been burnt off the previous summer: here the feed consists of young rushes and danthonia. A farm horse soon dies on this diet, but a working bullock pulls through. Horses for breaking in land should be hard fed.

March 21st, 1934: Whangarei.—Visited the Small-farm-plan Settlement on the tidal reclamation area at Pohe Island. These tidal flats were stopbanked and floodgated by the Whangarei Harbour Board in 1925 (5). After the salt water had been shut off for three years, some experimental grass-sowings were put down by the Department of Agriculture, and in 1933 the remainder of the area was sown to grass for small-farm-plan settlement. Open drains were first dug connecting with the main bank drain opening through the stopbank by means of floodgates, then parts of the area were underdrained with manuka fascine drains 2 chains apart. Good rye-grass, strawberry clover, and white clover pastures have been established, particularly on the areas that were underdrained. Strawberry clover is an excellent pasture plant on these areas, which until recently were covered with salt water. It will grow on land with quite a fair salt content, and is an excellent pioneer plant on areas not yet ready for grassing. In a pasture it occupies a similar place to white clover, which it resembles in a general way in foliage and habit of growth. This reclaimed tidal land in good rye-grass and strawberry clover pasture is excellent fattening country, and the development and grassing of this tidal land is receiving attention.

November 8th, 1934: Whangarei to Parua Bay.—A belt of greywacke highlands extends on the east coast from Cape Brett to Parua Bay: it is rugged country partly bush covered and partly grassed, with peaks reaching heights of 1,500 ft. The road from Whangarei to Parua Bay follows the coast, and for the first part of the journey—from Whangarei to Onerahi—the points consist of basalt. The hill pastures are mainly paspalum and danthonia with some ratstail near the coast, and buffalo-grass on the flats and lower slopes. In other districts such country is almost entirely given over to sheep, but here most of the farms appear to be milking quite a lot of cows. The best pastures—on the easy hills where the land has been ploughed—consist of rye-grass, paspalum, and white clover, and have quite a reasonable per-acre butterfat-production;

but on the steep hills where there is only danthonia, brown-top, and paspalum, without any clovers, the per-acre production of butterfat must be very low—for, without clovers, paspalum on this class of country does not throw a great deal of feed.

November 8th, 1934: Whangarei to Ngunguru to Hikurangi.—For the first part of the journey the road follows a long neck of basaltic volcanic land to Kiripaka and thence through steep greywacke hill country. Pastures are mainly danthonia and paspalum, with areas which have reverted to fern and manuka. Examined a sowing on a secondary manuka burn which had been sown last autumn. The grass mixture used had consisted of perennial rye, cocksfoot, and white clover: quite a good take had been secured on the manuka burn, and a remarkably good one on a small patch of light bush which had been included in the sowing. Now, this steep hill-country can be grassed successfully with rye-grass and white clover only if it is regularly, even though lightly, top-dressed. Without added phosphates, white clover does not persist, and without white clover rye-grass does not flourish. A high degree of fertility must be maintained for rye-grass. If top-dressing is not to be carried out, danthonia, brown-top, and dogstail are required in the grass mixture.

Paspalum has a place on this hill-country, but it demands fairly high soil fertility for good growth: on really poor dry soil it rapidly becomes sod-bound and produces little feed; on dry and hard hill-country reliance must be placed on danthonia and other low fertility demanding plants. Where the soil is moist, or fertility is kept up with top-dressing, paspalum is an excellent hill-country grass. It is particularly valuable for dealing with secondary growth, for it will thrive and persist under the shade of fairly tall fern and scrub and will recover after burning.

The bulk of the hill-country pastures in this area consist of danthonia and paspalum without much clover, and any top-dressing that is done on old grassland should be preceded and accompanied by the sowing of *Lotus major* and white-clover seed. *Lotus major* is a valuable plant on hill-country, although it is slow to establish. The plants cannot be introduced directly into a tight sward: the best plan is to sow the seed on bare knolls and where the soil is loose. November and December are the best months for sowing seed. Once established, the seed is spread out into the sward through cattle droppings. Close and continuous grazing hinders the establishment and spread of *Lotus major*: easing up grazing in the summer allows the plants to seed.

This greywacke highland forms the watershed between the east and west coasts, and returning to Hikurangi one looks over the rectangular central basin in which lies the Hikurangi Swamp, which is drained by the Wairua Stream flowing to the west coast through the gap between the Maunguru and Tangihua Ranges. The Hikurangi Swamp has recently been drained, and this has done away with prolonged winter-flooding to which the area was subject prior to drainage. The swamp consists of a central area near Hikurangi, with long arms extending into the hills surrounding the swamp. The soil is heavy, and was for the most part originally covered in heavy manuka. The pastures consist almost entirely of paspalum, and this is the common type of pasture on most of the land in North Auckland which has been

subject to flooding. With the present drainage many of these pure-paspalum swards could be improved to carry rye-grass and white clover along with the paspalum.

BAY OF ISLANDS COUNTY.

February 18th, 1935: Hukerenui to Ohaeawai.—At Hukerenui long sprawling spurs of Onerahi claystone run out into the valley of the Waipuakakahau Stream. There is some very good gum-land development work going on here. From Hukerenui to Kawakawa the country on the east consists of greywacke hills through which occur areas of basic volcanic soil, and on the west of these hills are low undulating gum-land areas on Onerahi claystones.

Ohaeawai is situated on a volcanic plateau of basaltic lava flows, dotted with steep-sided scoria cones. A pleasant farming district with well-cultivated farms and beautiful trees—groves of puriri and oaks planted by the early settlers. A good deal of the volcanic land is stony and is covered in danthonia and gorse, the latter neatly trimmed by sheep. Beyond Okaihau towards Kerikeri Inlet of the Bay of Islands lies a large area of unoccupied volcanic land underlain by old lava flows (locally known as "ironstone land" from the lumps of red ochre and limonite which strew its surface). The soil is thin and poor; the country is covered in low manuka scrub, bracken fern, and small kumarahou scrub. The Australian plant *Hakea avicularis* is rapidly spreading over this land, and in places is now the chief plant.

I stopped at a farm where some of this poor ironstone land is being cultivated. The land was cleared, ploughed, and sown in grass two years ago, but except where heavy applications of lime (1 ton and 2 tons per acre) had been applied, the results were poor. These soils are known as laterites and lateritic soils; like the grey gum-land silts their infertility is due to excessive leaching, but the process has been different in the two classes of soil. These soils show a zoned or banded appearance. On examination in one road-cutting the soil showed the following layers: First 12 in. of brown granular clay, then from 1 to 2 in. of yellowish brown soil with nodules of iron, then up to 5 in. of dull-brown granular clay on a reddish-brown nodular layer. The prolonged leaching that these soils have been exposed to has washed out the bases, and the soils lack potash and lime and are deficient in available phosphates. Iron compounds are present in sufficient quantities to render small dressings of phosphates of little value(2).

The good basic volcanic soils form the chief farming-areas of the Bay of Islands County, and farms are chiefly devoted to dairying and fat-lamb raising. These volcanic soils dry out rather badly in a dry summer, and pasture-production could be improved by the inclusion of paspalum in the grass mixtures on ploughed land. This season the summer rainfall has been very heavy and the pasture lands are looking remarkably well.

HOKIANGA COUNTY.

February 19th, 1935: Rangiahua to Maungamuka.—The main road skirts the eastern end of Hokianga Harbour and continues north into Mangonui County, rising sharply from Maungamuka over a saddle on the hills separating the Hokianga River Valley and Victoria Valley in

Mangonui County. I was first through this district in 1921, and a good many changes have taken place since then. Road improvement has been most marked, and in place of the impassable clay roads there are now fine metalled highways. Dairy-farm pastures show a marked improvement, though there appears on many surface-sown hill-country farms a good deal of reversion to fern and manuka. Pastures on the flat and low undulating limestone foothills are dominantly paspalum, and are pastures of high productivity. Originally the land was covered in mixed heavy bush and was surface-sown Successful pasture management, particularly on dairy-farms, has followed the lines of clearing up bush-burn debris, harrowing, and top-dressing. Considerable areas of undulating country have been ploughed and resown to grass, and this certainly gives the best results. Without top-dressing and harrowing the paspalum pastures on undulating land get very tight swards, with a poor clover growth, and the spring growth becomes increasingly late.

Farming in the Hokianga County consists in grazing Romney sheep and beef cattle on surface-sown hill-country and dairy-farming on the flat and undulating land in the river valleys. Dairy-farming is extensive rather than intensive. Little supplementary cropping is done, and only a small area is annually harvested for hay and ensilage There are 142,000 acres of sown grass in the county, with 500 acres devoted to annual crops and 900 acres cut for hay and ensilage to provide winter keep for 19,000 dairy cows In this district, with its abundant paspalum pastures, summer supplementary feeding is not usually required, and the rank autumn growth on paspalum fields is used for winter feeding. The weakness of the system lies in the shortage of good early spring feed.

I visited a dairy-farm on what until recently was part of a sheep- and cattle-grazing run The flats were rich paspalum pastures, but the hills had some paspalum with a good deal of bracken fern. In handling this hill-country with dairy cows the bracken cannot be crushed out. It must be got rid of by either cutting or harrowing, and this latter method is used a good deal in Hokianga. With the bracken cleared away, the next problem is to improve the sward with rye-grass and white clover. Some sort of a seed-bed is required—it is useless to sow on a hard, bare surface: the land should be heavily harrowed if ploughing and resowing cannot be done.

The Native settlers at Maungamuka have got considerable areas under cultivation for maize. The crops look exceptionally well, but army worms have stripped the leaves on some areas. Maize grows well on the rich river-flats, and its cultivation could well be extended as an adjunct to pig-keeping.

MANGONUI COUNTY.

February 20th, 1935: Kaitaia to Houhora.—Kaitaia lies in the valley of the Awanui River. There are areas of rich flat land in paspalum pastures from which rise low undulating scrub-covered hills: the Kaitaia Swamp lies just inside the coastal sandhills. Most of the pasture land consists of pure paspalum; summer production is heavy, but early spring growth is poor owing to lack of rye-grass in the pastures. The summer rainfall this year has been very good, and there is a tremendous paspalum growth on some fields, which farmers are cutting for hay. A good deal of

the hay lying out looks as if it had got thoroughly wet several times, and is a very bad colour. With the weather now being experienced it would be better to abandon haymaking and cut the green stuff for silage. This heavy paspalum, with a good leafy bottom, makes excellent silage—very valuable material for feeding in the early spring when feed on these flats is scarce. Hay badly spoilt by rain is not good for feeding cows in the spring, but good silage is excellent. The same thing is observable now in other parts of the North. If the weather is really unsettled it is not worth while "poking about" making hay when the alternative of ensilage is available. Waikato farmers learnt this long ago, but ensilage, although common in parts of the North, has not yet extended to all dairy-farms.

Beyond Waipapakauri stretches the long sandy peninsula of the Ninety-mile Beach. On these hills are found three distinct formations—moving dunes, which are now being stabilized by the planting of marram grass; recently consolidated sandy hills covered in manuka and fern, which are being fairly rapidly developed for dairy-farming; and older consolidated sandy hills where the surface soil has been badly leached, where drainage is bad and rushes are one of the main features of the vegetation: on these the iron podsol type of soil has been developed. An examination of a road-cutting at Waipapakauri on this leached soil showed the following banded formation: First 10 in. of a dark humus layer, then 4 in. or 5 in. of a light-coloured leached layer, then 9 in. of a darker layer which has been enriched by material from the upper layers, followed by irregular layers of hard pans with a deep continuous pan 4 ft. or 5 ft. down: this last pan is hard and impervious. The pans are formed by the humus and iron washed out of the surface layers cementing the sand particles together. It is these hard pans, which follow an irregular and complicated course, that render these older consolidated sands infertile.

The areas of recently consolidated sand which have not been leached like the older areas make quite good dairying land, and are being fairly rapidly developed for this purpose. They will carry good rye-grass, paspalum, white-clover swards, but most of the grassed areas consist of paspalum and subterranean clover—quite a fair pasture and one that can be established reasonably well with fairly primitive methods of cultivation. Where the aim is to establish a dominant rye-grass pasture, white is the best clover; but if rye-grass is not desired owing to the high degree of fertility which must be maintained for it to do well, then paspalum and subterranean clover make quite a good combination. Subterranean clover throws feed in the winter and early spring when the paspalum is dormant. For the establishment of first-class rye-grass, paspalum, and white-clover pastures the preliminary cultivation work must be good; perennial strains of rye-grass and white clover must be sown, and the land well manured with phosphates.

Between the sandhills lie old kauri swamps full of logs and stumps, and also peat areas which are here and there being developed. Drainage of peat lands wants to be done slowly and carefully. If the water is taken off too rapidly the peat dries out very badly; when really dried out, peat land is almost impossible to grass. On some of these peat areas I examined, a remarkable improvement

in pasture growth had been brought about with applications of superphosphate. Lime on these pastures had given little or no response. Some peat swamps respond to lime and others do not; the only satisfactory way to settle the matter is to try liming on a small plot.

February 21st, 1935: Awanui to Oruaiti via Lake Ohia and Mangonui.—The road from Awanui to Mangonui via Lake Ohia crosses a long series of unoccupied dismal-looking scrub- and rush-covered hills—rolling hills of sands, silts, and clays—the soils all showing the effect of excessive leaching. On the sands the soil profile shows a layer of sandy peat, then a layer of light leached sand, then a dark layer which has been enriched by humus carried down by water, then light sand, below which is a layer of dark cemented sand. The clays also show effects of leaching: first a thin humus layer, then a grey leached layer of silt below which is the unaltered clay. This is a poor infertile tract of land. The climate is good and no doubt the land will be developed some day, but it is likely to remain in its present condition until prices for primary products improve considerably. Beyond Mangonui the road traverses long stretches of dry red volcanic land on undulating scrub-covered hills. This volcanic land is very dry, and although it has not been critically examined its infertility is probably due to leaching. Quite a large area of Mangonui County is still unoccupied and unimproved. On this journey the road covered thirty-five miles of dreary scrub-covered hills with only a handful of actual farms.

WHANGAROA COUNTY.

February 21st, 1935: Kaeo to Keri Keri Plains.—Whangaroa County is the smallest in New Zealand: it has only 27,000 acres in sown grass, which carry 4,000 dairy cows, 4,000 other cattle, and 18,000 sheep. Dairy-farming is confined to the flat alluvial soils in the river valleys.

A certain amount of development work in the reclamation of tidal flats is proceeding at the head of the Whangaroa Harbour. The reclamation work on some of the flats was started a good many years ago, and pasture establishment has been brought about mainly by the slow spread of paspalum. On the reclaimed areas drainage is carried out with shallow open drains which are not particularly satisfactory. Open drains, unless deep and frequent, do not lower the permanent water-level: underground drains are required. Much more rapid improvement could be brought about if the reclaimed areas were underdrained with manuka-fascine drains. There is plenty of tall manuka on the foothills which could be used for this purpose. Underground drainage is necessary for rye-grass establishment.

Whangaroa County contains the northern end of the Keri Keri Plains—ironstone land which has already been described in Bay of Islands County.

SUMMARY.

We have traversed the whole peninsula from Auckland City to the far North and have seen the mountain ranges, the rolling hills of claystone, sandstone, and limestone, the scoria cones and volcanic plateau, the areas of consolidated sand, and flat alluvial land.

There are many places we have not been to and many things we have not seen. Some counties we have only glanced at; the native forest, now remaining only on the mountain-tops, we have passed by: there are areas afforested with *Pinus radiata* trees and tung oil and flax plantations that have not been examined.

A traveller to North Auckland immediately is struck by the amount of unoccupied scrub-covered land—surface-sown hill-country that has reverted to fern and manuka and open scrub country that has not been developed. The infertility of much of the open scrub country is due to the long-continued effect of soil-leaching. A good deal of these apparently infertile soils has already been developed: as prices for primary products improve more will be dealt with. Good cultivation, lime and phosphates, and perennial strains of grass and clover are all essential in bringing-in most of this poor soil. We leave North Auckland with the feeling that it offers great scope for future farm development.

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POTATO-GROWING IN NEW ZEALAND.

II.—DESCRIPTION OF VARIETIES.

R. THOMSON, Assistant in Agronomy, Government Pure-seed Station, Lincoln.

(Concluded.)

JERSEY BENNES.

Origin.—Not known, but the variety appears to be identical with International Kidney, which is the chief variety of the Jersey early potato trade. International Kidney was raised by R. Fenn, Sulhampstead, and introduced by Dean in 1879.

Foliage.—Haulm of medium height and vigour, fairly upright and open. Stem, colour 3. Wings inconspicuous. Stem nearly round. Leaf close, glossy; leaflets dark green, rounded, edges waved, terminals tied; secondaries large and numerous.

Flower.—White, small, rare; buds dark, drop early; flower-stalk fairly short.

Tubers.—Kidney (oval). Skin white and smooth. Eyes shallow. Eyebrow distinct. Flesh pale lemon. Sprouts blue.

Maturity.—First early.

Notes.—A variety which has gained favour during the last few seasons, more particularly in the southern part of the South Island. Its excellent shape combined with its earliness recommends it, but it requires sheltered situations. Certified lines are available.

FIG. 17. JERSEY BENNES.

KERR'S PINK.

Origin.—Fortyfold X Smith's Early. Raised by James Henry, of Ottawa, late of Brae, Cornhill, Banffshire, in 1907. Introduced into Great Britain by Mr. Kerr, Seedsman, of Banff, in 1917.

Foliage.—Haulm tall, upright, open, and very vigorous. Stem branched, colour 2, extending to midrib of leaf and flower-stalk. Wings waved. Leaf dark green, rigid, fairly close; leaflets fairly large, broad, and pointed, secondaries large and often borne on leaflet stalks.

Flower.—White, numerous, buds dark; flower-stalk long.

Tubers.—Round and somewhat flattened, dented at heel end. Skin pink and rough. Eyes medium to deep. Eyebrow fairly distinct. Flesh white. Sprouts pink.

Maturity.—Late main crop.

Notes.—A heavy cropping variety, but requires rich land on account of the large number of tubers produced. It cannot be recommended for commercial growing, while there is a prejudice against coloured-skinned potatoes (Dakota excepted). Its cooking quality is not regarded as equal to the Dakota, and it is feared that its distribution would detrimentally affect the trade in Dakotas. A little certified seed is available.

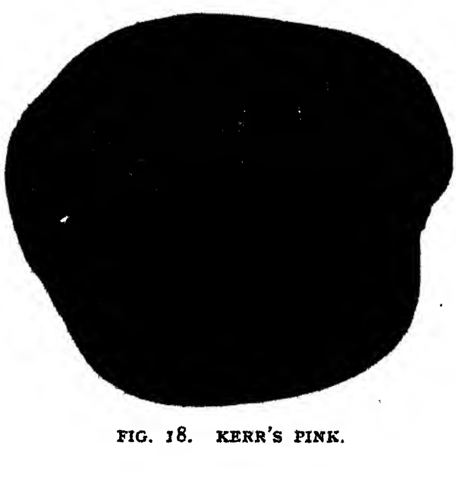

FIG. 18. KERR'S PINK.

KING EDWARD VII.

Origin.—Raised by a Northumberland grower, who called it Fellside Hero. It eventually came into the hands of Mr. Butler, of Scottar, who named it King Edward VII, and placed it on the market in 1902.

Foliage.—Haulm tall and erect, moderately vigorous and open. Stem, colour 2, variable. Wings waved. Leaf dark green and glossy; leaflets small, narrow, pointed, edges waved, the last pair tend to enfold the terminal; secondaries numerous, not large.

FIG. 19. KING EDWARD VII.

Flower—Red-purple tipped with white, rare, small; flower-stalks short.

Tubers—Oval to kidney, often tapering (pear shaped). Skin smooth, white splashed with pink. Eyes shallow. Flesh white Sprouts pink.

Maturity—Early main crop.

Notes—Is grown largely in Otago and Southland, where it does very well and commands a good price on southern markets. Not recommended beyond garden culture in other districts. Its mottled colour makes it difficult to define as either a red or white potato in the trade Red King Edward, Red King, and Rob Roy are selections from King Edward in which the tuber colour is entirely pink. Certified stocks are available

FIG. 20. LEADER.

LEADER.

Origin.—Unknown.

Foliage.—Haulm tall, upright, vigorous, and medium open. Stem, colour 2, particularly at nodes and leaf axils. Wings waved. Leaf distinct greyish-green when compared with Dakota; leaflets medium broad; secondaries small.

Flowers.—White, large; tall and prominent.

Tubers.—Round, often depressed at heel. Skin red and rough. Eyes fairly shallow. Flesh distinctly yellow. Sprouts deep pink.

Maturity.—Main crop.

Notes.—Only of importance as a rogue in Dakota stocks. Distinguished by its greyish-green foliage and yellow-fleshed tubers.

MAJESTIC.

Origin.—Raised by A. Findlay, of Auchtermuchty, Scotland, and introduced by him in 1911.

Foliage.—Haulm tall, open, and vigorous, commences to spread early. Stem, colour 0–1. Wings straight. Leaf light ashy-green, open; leaflets pointed, flat, pinkish colour in midribs when young; secondaries small and numerous.

Flower.—White, large, fairly numerous; flower-stalk long.

Tuber.—Kidney, tapering somewhat to heel end. Skin white and smooth. Eyes shallow. Eyebrow present. Flesh white. Sprouts pink.

Maturity.—Early main crop.

Notes.—Although a good cropper it cannot be recommended for commercial growing, as Aucklander Short Top is of a similar type and is much hardier. Majestic bruises very easily, and the loss sustained as a result of cutting the tubers for seed may, at times, be extremely severe. Certified seed is available.

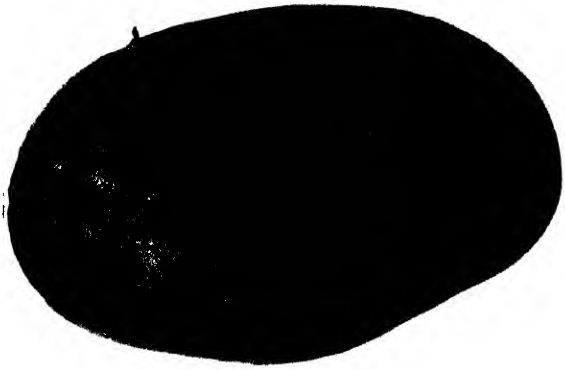

FIG. 21. MAJESTIC.

MAY QUEEN.

Origin.—Raised by E. Saddler, Bentham, and introduced by Sutton and Sons in 1900.

Foliage.—Haulm of medium height and vigour, spreading, medium compact. Stem, colour 1. Wings waved. Leaf medium green, glossy; leaflets large, curled upwards with waved margins, last pair overlap terminal; secondaries fairly large and numerous.

Flower.—Light blue-purple with white tips; fairly numerous; buds purple; flower-stalk long.

Tuber.—Kidney, sometimes tapered to heel. Skin white. Eyes shallow. Flesh white. Sprouts blue.

Maturity.—First early.

Notes.—Only suitable for garden use. Produces a fair crop of medium-sized tubers, but is a poor keeper. No certified stocks are available.

NEW ERA.

Origin.—A New Zealand selection which has been tested out in Great Britain and reported to be a bolter from Evergood. The latter was raised by A. Findlay and placed on the market in 1900. It was originally produced under the name of Eldorado. New Era, except for the roughness of the skin, corresponds with the descriptions of Evergood given by British authorities. Also known as Perfection or Perfection New Era.

Foliage.—Haulm tall, of medium vigour, upright to spreading, open. Stem, colour 0–1. Wings waved. Leaf open, dark greyish-green; leaflets crinkled, small, narrow, pointed (V shaped); secondaries small.

Flower.—Pale lavender, small, rare; buds green with coloured base, drop readily; flower-stalk long.

Tuber.—Short, oval, and flat. Skin white. Eyes shallow. Flesh lemon. Sprouts faint pink. Chief characteristic is the presence of tubers having a distinctly flaked skin; others are more or less smooth. Both types may arise from the same plant. Maturity and soil conditions may affect this characteristic.

Maturity.—Early main crop to main crop.

Notes.—Not recommended, although regarded by some as being useful in parts of the North Island on account of its resistance to late blight. Susceptible to mosaic, and very susceptible to internal brown fleck. No certified stocks are available.

FIG. 22. NEW ERA

NEW ZEALAND WHITE ELEPHANT.

Origin.—Not known. Distinct from American White Elephant. (See New Zealand White Beauty of Hebron.)

Foliage.—Haulm very tall, vigorous, upright, and open. Stem much branched, colour 2, extending to midrib of leaf and flower-stalk. Wings large and waved and mottled blue-purple. Leaf pale green; leaflets small, fairly broad, crinkled; secondaries intermediate.

Flower.—Blue, occasional. Calyx tinged red-purple. Buds drop readily. Flower-stalk fairly short.

Tuber.—Oval, flattened at heel and notched, shape irregular, and much second growth. Eyes very deep with large bump above eye. Skin medium to smooth; white, tinge of purple at heel of freshly dug tuber. Flesh white. Sprouts blue.

Maturity.—Late main crop.

Notes.—Synonymous with Australian Snowflake. Crops heavily on moist rich land. A good garden variety of excellent table qualities, but not suitable for

commerce on account of its rough shape and the brittleness of the tubers. This variety will not be passed by the Port Graders in the South Island for the North Island trade. No certified stocks are available.

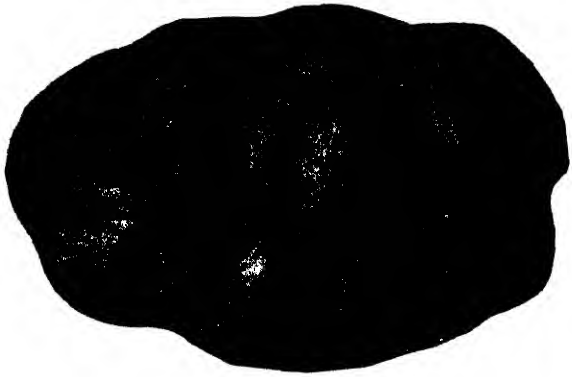

FIG. 23. NEW ZEALAND WHITE ELEPHANT.

NORTHERN STAR.

Origin.—Not known. Introduced to commerce by Findlay in 1900, and caused much excitement in Great Britain, being sold for as much as £25 per ton. It is grown under several names in New Zealand—*e.g.*, Britain's Best, Gamekeeper, &c. J. Beverley records (this *Journal*, Vol. X, p. 357) that the latter variety is distinct in the flower. The writer has grown a number of so-called variations, but under the one environment they have differed very little, if any, from typical Northern Star.

Foliage.—Haulm strong, upright, tall, and dense. Stem branching, colour 0–1, but discernible in the midribs of the young leaves. Wings waved. Leaf dark grey-green, rigid ; leaflets small, pointed ; secondaries small, moderately numerous

Flower.—Small, white, rare, mostly drop before opening ; flower-stalk short.

Tubers.—Round. Skin white, moderately rough. Eyes medium, fairly deep at rose end. Flesh white. Sprouts pink. There is a single spot of pink in the eye most noticeable in the terminal buds, and some pink at the heel end of an immature tuber. Produces numerous long runners and small tubers.

Maturity.—Late main crop.

Notes.—Of commercial importance in the Pukekohe district only, where it is planted for an early crop, and the seed put straight back into the ground for a second late crop. Elsewhere it is the chief rogue in potato stocks on account of the large number of seed-sized tubers produced. Distinctly resistant to late blight. Maori Chief is a selection from Northern Star, having tubers splashed with purple, while Sir J. G. Wilson has all purple tubers and pale purple flowers.

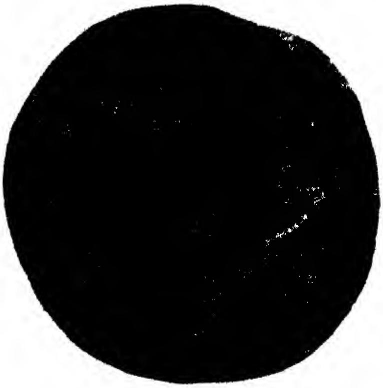

FIG. 24. NORTHERN STAR.

READING RUSSET.

Origin.—Raised by R. Fenn, Sulhampstead, and introduced by Sutton and Sons in 1882.

Foliage.—Haulm of medium height, compact, later spreading. Stem, colour 2. Wing waved. Leaf medium grey-green ; leaflets long, narrow, pointed ; secondaries fairly numerous, pointed.

Flower.—White, fairly numerous , flower-stalk fairly short.

Tuber.—Round, flattened Skin deep pink, russeted Eyes shallow. Flesh white. Sprouts deep pink

Maturity.—Second early.

Notes.—Of no commercial importance except as a rogue in Dakota stocks. It is distinguished by its greyer-green, narrower foliage, more spreading habit, round tubers, and earlier ripening.

ROBIN ADAIR.

Origin.—Mr. J. H. Nimmo, of Nimmo and Blair, advises that many years ago this potato was grown by Mr. Shepherd at Adair, near Timaru, under the name of Cardinal It was renamed Robin Adair by Mr. Nimmo, and has been grown ever since under that name. Robin Adair tallies fairly well with the description given by British authorities for Cardinal, except that the flower is creamy white, whereas it is red-purple in Cardinal

Foliage.—Haulm of medium height and vigour, very spreading and open. Stem, colour 2, pronounced in axils of leaves and leaflets. Wings more or less straight. Leaf open, light green ; leaflets small, rounded, terminal drooping ; secondaries rounded.

Flower.—White, numerous ; flower-stalk long.

Tubers.—Kidney to long, flattened, often curved. Skin red, sometimes very smooth, other times netted. The netted tuber is generally shorter and more blunt at the rose end. The variation is probably caused by environment. Eyes shallow and evenly distributed Flesh white, often streaked with red Sprouts pink.

Maturity.—First to second early

Notes.—Not of great commercial importance, and very susceptible to blight. Grown mainly to supply seed for garden use, for which purpose it is very popular. Certified stocks are available. Knowler is a selection from Robin Adair in which the skin is splashed with colour. It was raised by Mr Knowler, of Southland.

FIG. 25. ROBIN ADAIR.

SHARPE'S EXPRESS.

Origin.—Not known. Introduced to commerce by Charles Sharpe, of Sleaford, England, prior to 1901.

Foliage.—Haulm of medium height, spreading, vigorous. Stem, colour 0–1. Wings inconspicuous, waved. Leaf close, due to large and numerous secondary leaflets; leaflet bright green and glossy, distinctly pointed forward; last pair overlap terminal.

Flower.—Red-purple, rare; buds drop readily; flower-stalks short.

Tuber.—Kidney, tapering to heel end (pear-shaped). Skin white, smooth. Eyes shallow and on point of tuber. Flesh white to intermediate. Sprouts pink.

Maturity.—First early to second early.

Notes.—Only a fair cropper, and very subject to hollow heart. Cannot be recommended for commercial growing. No certified stocks available.

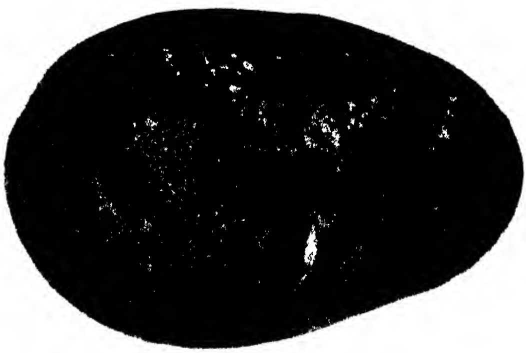

FIG. 26. SHARPE'S EXPRESS.

SCOTIA.

Origin.—Not known.

Foliage.—Haulm tall, vigorous and open, upright, but not so much as Dakota. Stem, colour 2–3. Wings more or less waved. Leaf soft grey-green due to presence of hairs; leaflets large, rounded; terminal leaflets often joined; secondaries medium.

Flower.—Blue-purple tipped white, rare; buds drop early; flower-stalk long.

Tuber.—Round. Skin red. Eyes medium, rose end deep. Flesh white, turns dark on cooking. Sprouts deep pink.

Maturity.—Main crop.

Notes.—Only of importance as a rogue in Dakota stocks. It is distinguished by its greyish foliage, fusion of the terminal leaflets, scarcity of flowers, which, if present, are blue in colour.

UP-TO-DATE.

Origin.—Introduced to commerce by A. Findlay in 1894, and said to be the result of Patterson Victoria X Blue Don. Field Marshal is identical with Up-to-Date, except that the tubers have a russet skin.

Foliage.—Haulm tall and vigorous, semi-erect, and fairly open. Stem branching, colour 1–2. Wings waved. Leaf large, fairly close, light to medium green; leaflets large, the end pair overlap the terminal; secondaries numerous.

Flower.—Light red-purple, numerous, lasting over a long period; flower-stalk long and thick. Colour shades off towards tips of petals, but is not distinctly white-tipped.

Tuber.—Oval to kidney, flattened. Skin white and smooth, sometimes roughened. Eyes shallow, mainly at rose end and on upper surface. Flesh white. Sprouts pink.

Maturity.—Main crop.

Notes.—One of the best varieties ever grown, and regarded by many as the ideal potato. A good cropper of good shape and quality. Unfortunately, stocks

deteriorate so rapidly through virus diseases that it is now of very little commercial importance. Certified stocks are available, and in districts not conducive to the spread of virus and late blight the variety is still worth growing. Bolters and wildings occur. The popularity of the variety can be judged by the fact that the Scottish Board of Agriculture reports no less than 275 synonyms

FIG. 27. UP-TO-DATE.

WITCHILL (RESISTANT SNOWDROP).

Origin Produced by John Perkins, of Northampton, prior to 1881, and reselected by Dobbie and Co. as Resistant Snowdrop The variety is of historical interest in view of the fact that it was the first to be definitely observed as immune to wart disease.

Foliage.—Haulm of medium height and vigour, spreading and dense. Stem, colour 0-1. Wings waved. Leaf medium green, open, long; leaflet long, thin, with a tendency to curl, secondaries few, small.

Flower - White, rare; flower-stalk short, bolters flower freely.

Tuber.—Kidney (long oval), flat. Skin white, smooth. Eyes very shallow. Flesh white. Sprouts pink.

Maturity.—First early to second early.

Notes.—Susceptible to late blight, yield only fair. Cannot be recommended commercially. No certified stocks available.

FIG. 28. WITCHILL (RESISTANT SNOWDROP).

In preparing the varietal descriptions free use has been made of information available from the following publications:—

"Potato Varieties": R. N. Salaman, M.D., Cambridge University Press.

"The Potato": Thomas P. McIntosh, B.Sc., Board of Agriculture, Scotland.

"Potato-growing for Seed Purposes": W. D. Davidson, B.A., B.Sc., Journal of Agriculture, Ireland.

"The Potato": William Stuart, U.S.A. Department of Agriculture.

"Potato Culture": J. W. Hadfield, New Zealand Department of Agriculture (Bulletin No. 142).

SORE-SHIN OF BLUE LUPINS.

ITS IDENTITY WITH PEA-MOSAIC.

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North.

"SORE-SHIN," a destructive disease of blue lupins (*Lupinus angustifolius*), has already been described and its causal agent shown to be a virus (Neill, Brien, and Chamberlain, 1934). More recently an obscure disease of lupins has been described by Richter (1934) as occurring in Germany. From his description it would appear that the European disease is very similar to if not identical with sore-shin.

The experiments detailed in this article were undertaken to determine the relationship, if any, between sore-shin and other virus diseases occurring in the Dominion.

ARTIFICIAL CROSS-INOCULATION EXPERIMENTS.

In most cases the host range of a virus disease is confined to the members of one family of plants. Since the garden pea is a commonly grown member of the Leguminosæ, the family to which lupins belong, a preliminary attempt was made to transmit sore-shin to this plant.

EXPERIMENTAL METHOD.

Garden peas, Green-feast variety, were grown in 6 in. porous flower-pots (five plants per pot) and inoculations carried out when the plants were about 6 in. tall. The inoculum was obtained from freshly infected lupin plants collected from the field. These were pulverized in a sterile mortar and the juice strained through muslin. The inoculations were made by rubbing from six to eight leaflets of each of the healthy pea-plants with muslin moistened with the undiluted juice. A similar technique was used when cross-inoculations were made from garden peas to sweet peas and from garden peas back to lupins (see also Neill, Brien, and Chamberlain, 1934).

RESULTS.

In a preliminary experiment twenty-four pea-plants were inoculated with juice from sore-shin-infected blue lupins and twenty-four plants

left uninoculated. Of the inoculated plants six developed typical symptoms of pea-mosaic* (fig. 1), while all the uninoculated plants remained healthy.

In order to check the identity of the mosaic which developed on the pea-plants in the above experiment an attempt was made to transfer the disease to sweet peas. Using the juice of the infected plants as an inoculum twenty sweet-pea plants were inoculated. Of these, two plants developed typical pea-mosaic symptoms. Ten uninoculated sweet-pea plants remained healthy.

To ascertain whether the mosaic symptoms on the peas were brought about by the virus causing sore-shin and were not due to any chance

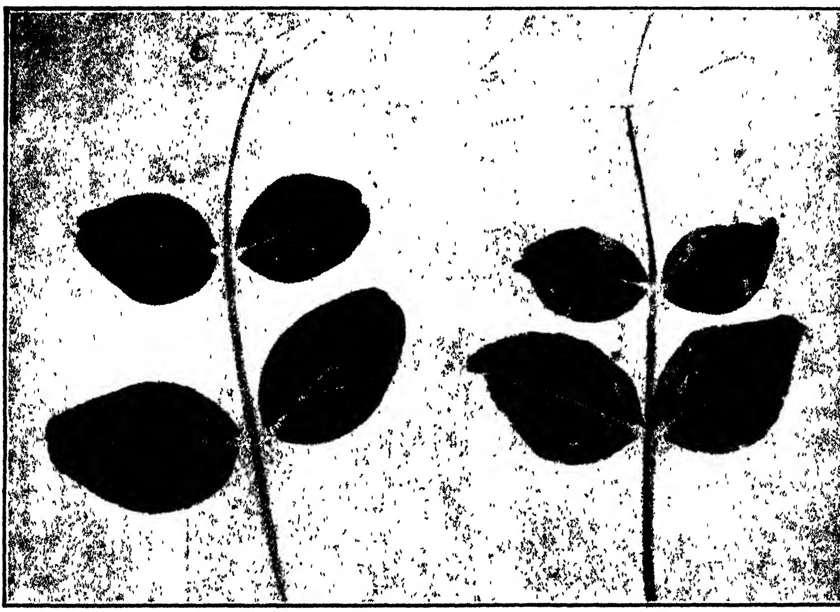

FIG. 1. PEA-MOSAIC HEALTHY LEAF ON LEFT.

[*Photo by H. Drake.*

contamination, an attempt was made to transfer the disease back to lupins. Nine lupin plants were inoculated with juice from one of the mosaic-infected pea-plants, and of these two developed typical sore-shin symptoms. Five control plants remained healthy.

It is apparent from these experiments that the virus causing sore-shin of lupins is also capable of producing a mosaic of garden and sweet peas.

Insect Transmission.

The spread of virus diseases takes place through the agency of insects, by mechanical transmission during the handling of the plants,

* Pea-mosaic is a virus disease common on garden peas throughout New Zealand. The same virus also attacks sweet peas, broad beans, red clover, and various other clovers.

or through the soil. Since lupins are not handled during the season and transmission of virus through the soil is very rare, it seemed probable that sore-shin infection was brought about by insects. Experiments were therefore undertaken to determine whether any of the common insects known to be vectors of other virus diseases in New Zealand were concerned in the transmission of sore-shin.

A careful search, at various seasons of the year, for insects on blue lupins in the field resulted in the discovery of only one species—*Thrips tabaci**. In preliminary experiments, therefore, an attempt was made to transmit sore-shin by means of this insect.

FIG. 2. MUSLIN CAGE DRAWN OVER WIRE FRAME.

The method employed for confining aphides to the lupin plants during transmission experiments. [*Photo by H. Drake.*

THRIPS.

During the summer months thrips are very plentiful on lupins, and are readily collected from the axils of the leaves.

Experimental Method.—Two methods were used for caging the thrips on the plant —(1) The method described by Cottier (1931); and (2) a method in which the thrips were confined to the lower portion of the plant by means of a lamp-chimney capped with cotton-wool.

* This identification was kindly made by Mr. J. Muggeridge, Entomologist, of this Station.

Results.—Using the first method, from twenty-five to thirty thrips, collected from infected lupins in the field, were placed on each of five plants, but no infection took place. In another experiment, using the second method, twelve thrips were added to each of twelve plants and again no infection occurred. Seventeen control plants also remained healthy.

Although these experiments were not sufficiently extensive to make the results conclusive, yet it would appear that sore-shin is not readily transmitted by thrips.

APHIDES.

Although aphides have not been observed to occur naturally on blue lupins, it was decided to attempt transmission with the two species—*Aphis rumicis* and *Myzus persicae**—which most readily transmit pea-mosaic between other legumes. The transmission was carried out in

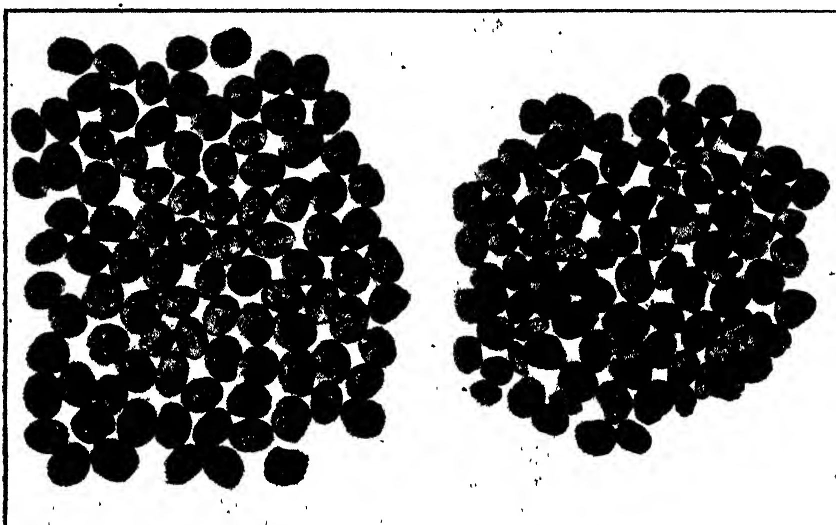

FIG. 3. EFFECT OF SORE-SHIN ON LUPIN-SEED

Equal numbers of seeds from healthy (left) and sore-shin-infected plants.

[*Photo by H. Drake.*

each case from either mosaic-infected broad beans or garden peas. These plants were grown in the glasshouse and had been infected with mosaic from naturally infected broad beans collected from the field.

Experimental Method.—The lupins were grown in 6 in. pots (five plants per pot). The aphides were placed on the plants when the latter were about 6 in. tall. Wire frames were then fitted to the pots and muslin cages drawn over and secured (fig. 2). The check plants were treated similarly, except that no aphides were placed on them. At the end of four or five days the cages were removed and the plants fumigated, except in a few instances where all the aphides had died.

*** The identification of these aphides was kindly made by Mr. W. Cottier, Assistant Entomologist, at this Station.**

Results.—The results of the aphis transmission experiments are given in the following table:—

Table I.—Aphis Transmission of Sore-shin of Blue Lupins.

Date of Insect transference.	Plant from which Aphides transferred.	Species of Aphis.	Number of Aphides transferred to each Plant.	Number of Plants.	Incubation Period.*	Percentage of Plants infected.
					Days.	
8/5/34	Mosaic broad bean	*Aphis rumicis* ..	24–36	8	7	100
	..	Control ..	..	3	..	0
11/5/34	Mosaic broad bean	*Aphis rumicis* ..	12	5	Not noted	80
	..	Control ..	..	3	..	0
28/1/35	Mosaic broad bean	*Aphis rumicis* ..	12	10	6	100
	..	Control ..	..	5	..	0
5/6/35	Mosaic garden pea	*Myzus persicae*	6	17	10	12
	..	Control ..	..	13	..	0
18/6/35	Mosaic garden pea	*Myzus persicae*	24–36	9	6	89
	..	Control ..	..	10	..	0

* The figures given in this column represent the number of days which elapsed before the first symptoms appeared. The symptoms did not appear on all plants at the same time, being delayed on some plants for from one to three days.

As a check on the diagnosis of the disease produced by aphis transmission sixteen healthy lupin-plants were artificially inoculated with juice from one of the infected plants. Four of the sixteen developed typical sore-shin symptoms, while eight uninoculated plants remained healthy.

From the results given in the above table it may be seen that sore-shin is readily transmitted by both *Aphis rumicis* and *Myzus persicae.*

Also, since the transfers were made from plants infected with naturally occurring mosaic of broad beans, it is apparent that sore-shin and broad-bean mosaic are caused by the same virus.

SEED TRANSMISSION.

Only those plants which have become infected late in the season produce any seed, and that which is formed is usually small and misshapen (fig. 3). An experiment in which 115 plants, grown from the seed of sore-shin-infected lupins, failed to develop any infection has already been recorded (Neill, Brien, and Chamberlain, 1934). Since then further trials have been carried out and a total of 405 seeds, collected from naturally infected plants, have been sown in sterilized soil in the glasshouse. Of the seed sown 315 (75 per cent.) germinated, and all the plants remained free from sore-shin. The indications are, therefore, that sore-shin is not a seed-borne disease.

Natural Method of Spread.

Since sore-shin does not appear to be seed-carried, and since lupins are not grown throughout the season, it is apparent that for spring infection to occur spread of the disease must take place from some other host. The most commonly occurring alternative host of sore-shin is red clover*, and observations suggest that this plant is implicated in the overwintering of the disease.

All plantings of red clover made at the Plant Research Station Area within the last four years have developed a high percentage of mosaic, and all crops of blue lupins grown in their vicinity have become severely infected with sore-shin (fig. 4). In the spring of 1934 blue lupins and

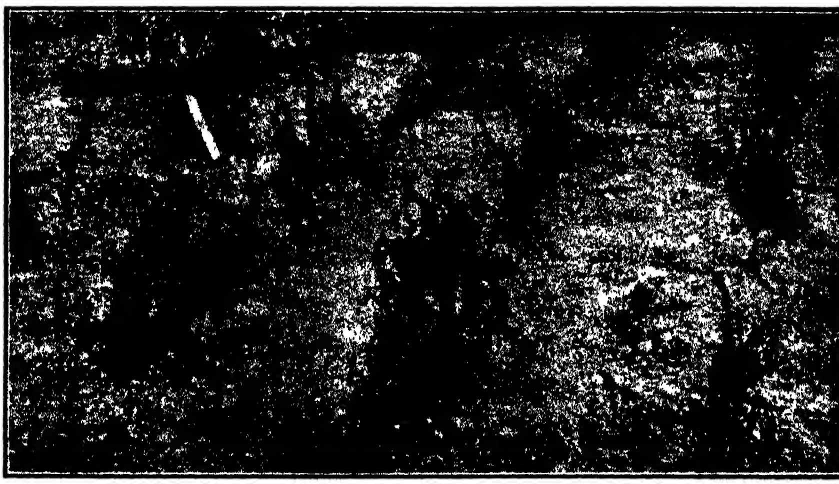

FIG. 4. EFFECT OF SORE-SHIN ON BLUE LUPINS IN THE FIELD.

A section of a crop showing 100-per-cent. infection grown in close proximity to a plot of mosaic-infected red-clover plants. [*Photo by H. Drake.*

Green-feast garden peas planted within 1 chain of mosaic-infected clover-plants developed 93 per cent. sore-shin and 89·5 per cent. mosaic respectively. Green-feast peas grown on another portion of the farm developed about 0·25 per cent. mosaic, and blue lupins also grown at some distance from red clover showed a sore-shin infection of about the same order.

Summary.

(1) It has been shown by cross-inoculation experiments that sore-shin of blue lupins is produced by the same virus that causes pea-mosaic.

(2) Sore-shin may be transmitted to lupins from mosaic-infected broad beans and garden peas by means of the aphides *Aphis rumicis* and *Myzus persicae*.

* A mosaic disease, which is caused by the same virus that brings about pea and broad-bean mosaic and sore-shin of lupins, is very prevalent on red clover.

(3) Experimental results indicate that the disease is not seed-carried.

(4) Observations in the field indicate that the disease overwinters as mosaic on red-clover plants.

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NEILL, J. C., BRIEN, R. M., and CHAMBERLAIN, E. E. (1934): *N.Z. Journ. of Agric.*, Vol. 49, pp. 139–146.
RICHTER, H. (1934): *Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, Vol. 14, pp. 81–82.

APHIDES AFFECTING CULTIVATED PLANTS.

(5) APHIDES OF THE BEAN, TURNIP, STRAWBERRY, PUMPKIN, AND PRIMROSE.

W. COTTIER, Entomology Section, Plant Research Station, Palmerston North.

THE common aphid of the bean is the black *Aphis rumicis*, while those of the strawberry and pumpkin are *Capitophorus fragariae* and *Aphis gossypii* respectively. There are two common aphides of the crucifer family (turnip rape, cabbage, &c.)—viz., *Brevicoryne brassicae* and *Myzus persicae*, the latter of which has already been described in this *Journal* for May, 1935. There is also a third, *Aphis pseudobrassicae*, which does not appear to be as freely distributed as are the other two. The common aphis of the primrose is *Myzus primulae*.

Throughout the summer there are commonly encountered two forms of each aphid species—viz., the wingless and winged individuals, both being female. These forms reproduce by giving birth to living young, and are styled "viviparous" because of this characteristic. In the following accounts these two forms have been described for each species as an aid in identification.

THE BLACK BEAN APHID (APHIS RUMICIS).

The wingless viviparous female is approximately 2 mm. long and is globular in form. In colour it is usually a dull black with the first two-thirds of the antennæ very light. The legs are also very light in colour. The antennæ or "feelers" are shorter than the body.

The winged viviparous female is the same colour as is the wingless female, and approximately the same in size.

HOSTS IN NEW ZEALAND.

The writer has found this aphid on beans, *Vicia* sp., and sweet peas.

OBSERVATIONS.

This aphid is very common on all types of beans. Broad beans seem to be particularly susceptible. The black insects cluster thickly on the succulent terminal parts of the stem and shoots, causing deformation of the leaves and, in cases of severe infestation, stunting and wilting of the plants. As far as the writer is aware the life-history of this insect in New Zealand has not been worked out. Theobald

(Plant Lice of Great Britain, 1927) states that the aphid lays winter eggs on *Euonymus*, *Rumex*, rarely on *Viburnum opulus*, and in America on *Chenopodium*. In England this aphid is known as the "Collier" black-fly or black death, this last presumably on account of its destructive nature. It is quite common to see blow-flies hovering around broad beans infested by *Aphis rumicis*, for the purpose of feeding on the honey-dew exuded by these insects.

Aphides of the Swede, Rape, and Cabbage.

THE GREEN APHID (MYZUS PERSICÆ).

As mentioned above, this aphid has already been described in this series. It is very common on young plants of swede, rape, and cabbage early in the spring. As the plants become older infestation by this aphid seems to become less. The insect appears to cause but little permanent damage, but infested plants must be retarded somewhat in growth. Infestation by *M. persicae* on brassicas is a source of supply of this aphid to neighbouring potato-fields in the spring, and this is worth noting because of the importance of this insect as a transmitter of potato virus diseases. It has been demonstrated that in New Zealand *M. persicae* regularly passes the winter in the summer form on brassicas such as rape and swedes.

THE MEALY APHID (BREVICORYNE BRASSICÆ).

The wingless viviparous female is greyish-green in colour, and is thickly covered with a white mealy powder. The length of the body is approximately 2 mm and the antennæ are shorter than the body.

The winged viviparous female has the head and thorax black or almost so. The abdomen is green with several dark markings; the antennæ are almost as long as the body; the length of the insect is approximately 2 mm.

HOSTS IN NEW ZEALAND.

Cruciferous crops generally—*e.g.*, rape, turnips, cabbage, Brussels sprouts, cauliflower, wild mustard, shepherd's purse, and watercress.

OBSERVATIONS.

This aphid is frequently the cause of severe damage to brassica crops —*e.g.*, swedes—injuring both the leaf and the seed-stalk The distribution of this pest is world-wide, apparently occurring in all countries where brassicas are grown. The aphid feeds both on the upper and lower surfaces of the leaves, and is very abundant on flower-stems and even on seed-pods. The colonies at first are very small and cause curled-up portions on the leaves, and these act as shelters for the developing colonies. The aphid first appears in noticeable numbers on scattered and widely separated plants about January, or perhaps even as late as February. At this time the few infested plants can be easily picked out as being covered with the insects, while surrounding plants are apparently clean. In a few weeks, however, during a favourable season, the colonies have spread to neighbouring plants, and it is not long before such plants are a wilting mass giving off a characteristic unpleasant odour.

It is generally understood that a long dry season is favourable to the pest. The greatest infestation will generally, however, be found in sheltered hollows, where there is usually a more humid atmosphere, and these places act as centres of distribution. One can usually pick badly infested spots on account of their "heavier" atmospheres.

In New Zealand during the winter this aphid lives in the normal summer stages on winter greens, though, of course, reproduction is very greatly retarded by the lower temperatures. When spring arrives winged aphides are produced, and these fly away to start colonies on new crops. In countries with very cold climates the aphid lays winter eggs on winter crucifers, the cold season being passed in this way.

B. brassicae is much parasitized by various hymenoptera, the brown, swollen, and dried parasitized aphides being numerous in every colony. The insects are also attacked by the larvæ of hover flies, and also by aphis lions. The 11-spotted red and black ladybird *Coccinella 11-punctata* is very common in *B. brassicae* colonies, and must do a great deal of good in destroying many of the aphides. Entomogenous fungi are also useful in this respect. In New Zealand, however, up to the present time, natural control has not been effective enough in reducing the pest.

THE FALSE MEALY APHID (APHIS PSEUDOBRASSICÆ).

The body of the wingless viviparous female is usually a light-greenish colour with the head somewhat dusky. The body generally is dull and very lightly covered with a powdery substance, except for a series of shining areas along the back. The antennæ are about half the length of the body. The length of the insect is approximately 2 mm.

The head and thorax of the winged viviparous female are black, while the abdomen is pale green with several black markings. The antennæ are shorter than the body, which is approximately 1·5 mm. long.

HOSTS IN NEW ZEALAND.

So far collected from cruciferous weeds only.

OBSERVATIONS.

This aphid is similar to *Brevicoryne brassicae*, but can be separated at once by the characters of the cornicles and cauda. (For explanation of terms see No. 2 of this series in this *Journal* for May, 1935.) It would seem that this species is not common enough in the Dominion to cause serious injury to plants, and from the economic aspect is worthy of little comment. The life-history in New Zealand has not been followed.

THE STRAWBERRY APHID (CAPITOPHORUS FRAGARIÆ.)

The head of the wingless viviparous female is somewhat dirty white in colour, while the body is almost the same faintly tinged with green. The insect is from 1 mm. to 1·5 mm. long, with the antennæ as long as the body. Knobbed hairs are present on the head and body.

The head of the winged viviparous female is dark brown, the thorax being green with dark brown markings. The abdomen is

pale green with dusky markings. The antennæ are approximately as long as the body, which measures approximately 2 mm. There are a few knobbed hairs on the body and head.

HOST IN NEW ZEALAND.

The strawberry is the only known host.

OBSERVATIONS.

This insect occurs very commonly on the undersides of strawberry leaves, often in great numbers, the aphides appearing to be closely appressed to the leaf. The low habit of the host plant, with the leaves close to the ground, probably provides very favourable conditions for rapid multiplication of aphid colonies, since most species appear to favour such sheltered places. The aphid passes the winter in the normal summer form on such strawberry foliage that is on the plants during the winter season, though, of course, reproduction takes place slowly during cold weather. Chamberlain of this Station and A. M. Massee of East Malling Research Station, England, have demonstrated that this aphid is a carrier of strawberry-virus degeneration disease from infected to healthy plants. This virus disease is capable of reducing the yield of berries very greatly in a few years. Apart from any mechanical injury caused by the sucking-out of the sap and so producing dwarfed and unthrifty plants, this aphid now therefore assumes a new significance, and if good crops are to be secured then it is imperative that this insect be destroyed. For Chamberlain's paper on strawberry-virus transmission, see this *Journal* for October, 1934 (Vol. 49), p. 226.

THE PUMPKIN AND MELON APHID (APHIS GOSSYPII).

The wingless viviparous female is yellow to green in colour; its antennæ are about half the length of the body and are light in colour for the greater part of their length. The length of the insect is approximately 1·5 mm. to 1·9 mm.

The winged viviparous female has the head and thorax black. The abdomen varies from yellow to green with several dark markings. The antennæ are shorter than the body, which is approximately 1·2 mm. to 1·9 mm. long.

HOSTS IN NEW ZEALAND.

The writer has records from pumpkin only.

OBSERVATIONS.

This aphid is quite common on pumpkin in New Zealand, sometimes curling the young leaves. In other countries it has been found infesting melon, cucumber, and cotton, and is commonly called the melon aphid, or the cotton aphid. It is a world-wide species. Evidently this aphid overwinters in the summer stages on suitable winter hosts. It has been stated that winter eggs of this aphid have been found, but it seems to be uncertain whether it is normal for the aphid to overwinter in the egg stage.

THE PRIMROSE APHID (MYZUS PRIMULÆ).

The wingless viviparous female has the head and body of yellowish-green. The antennæ are light in colour and approximately as long as the body, which is from 2·2 mm. to 2·5 mm.

The head and thorax of the winged viviparous female are brown, while the abdomen is green to pale yellowish-green with several dark transverse markings. The antennæ are approximately as long as the body, which is about 2·5 mm.

HOSTS IN NEW ZEALAND.

Primroses.

OBSERVATIONS.

This aphid is quite common on the undersides of the leaves of the primrose. It is quite a good-sized species, but is often overlooked on account of its colouring resembling the leaf so closely. The life-cycle in New Zealand has not been followed.

CONTROL.

It is to be understood that aphides always increase at a much greater rate on plants in sheltered positions than on those in exposed situations. So that if it is possible to choose between these two types of location for plants, other things being equal, then avoid the more sheltered one. For example, swedes grown in a protected hollow will be far more likely to be attacked by aphides than will a crop growing on an exposed hillside. This may be worth considering when deciding on a suitable location for the crop. The influence of shelter on aphid population seems to apply to all species. The strawberry and primrose, with their leaves close to the ground, are plants that provide excellent cover for these insects.

For the control of the strawberry aphid where it is bad, the following operations are worthy of serious consideration. In the autumn when the fruiting-season is over, and in districts where the beds are down for two seasons or more, all leaves should be cut off the plants with a scythe, care being taken not to injure the crowns. Over the beds there will usually be a light covering of straw which has been used earlier in the season to prevent the berries from coming into contact with the soil. This straw, together with the cut-off leaves, should be teased up with a pitchfork and the whole fired from one side on a day when a good cross-wind is blowing so that the fire will traverse the whole bed quickly. Provided there is only a light covering of rubbish over the beds, the fire will sweep swiftly across and no damage will be done to the crowns. At the same time, all aphides will be destroyed. The only alternative to this operation is to cut off all leaves, rake them off the beds into heaps, and burn them at once. If the infestation has been very bad it may be necessary to spray the denuded crowns with nicotine sulphate—1 part to 800 parts of water plus soft soap from 3 lb. to 4 lb. per 100 gallons of spray. These operations are advised for the purpose of destroying over-wintering aphides, since these insects cannot, of course, carry over to the next spring if there are no leaves for them to feed on during the winter. It is a good practice to spray with nicotine sulphate of the above strength when the young leaves are beginning to grow in the early spring. If the infestation becomes bad during the summer, spray when necessary with nicotine sulphate and soap. Infested runners, after they have been planted out and become rooted,

should be given a treatment with this spray. Another way of treating runners to free them from aphides is the hot-water method. Before being planted out the runners are immersed in hot water at a uniform temperature of 110° F. for twenty minutes. The runners should be placed loosely in the bath to allow even penetration of the heat. Only vigorous and strongly rooted plants should be treated. Treatment should be carried out only when immediate planting can be done. It is very important to keep the temperature of the bath constant at 110° F.; if this temperature is exceeded injury might result to the plants, and if it is not attained the results are not satisfactory.

For the control of the other aphides in small areas, spray with the above strength of nicotine sulphate plus soap. It is wise to be on the watch for these insects and to spray when they first appear. This is very important, particularly with the mealy swede-aphid, *Brevicoryne brassicae*, as the first few colonies can be killed comparatively easily, but later on, when infestation has become general, control is much more difficult. With aphides such as the mealy swede-aphid and the black bean-aphid, which cluster thickly on infested stems, it is usually necessary in bad cases to spray twice with nicotine sulphate plus soap at an interval of from seven to ten days.

ACKNOWLEDGMENT.

The writer wishes to thank Mr W. K. Dallas of this Station for certain of the material embodied in the above paper.

LEMON MANURIAL EXPERIMENT AT TAURANGA.

INTERIM SUMMARY OF RESULTS COVERING FIRST FOUR YEARS OF EXPERIMENT.

W. K. DALLAS, Citriculturist.

A SERIES of manurial experimental plots were laid down on the 26th September, 1930, in the orchard of Messrs. Mayfield Bros., Bethlehem, Tauranga.

The object of the experiment was to determine the effect of the following treatments upon yield, quality of fruit, and tree growth —(1) Superphosphate; (2) superphosphate and sulphate of ammonia; (3) superphosphate, sulphate of ammonia, and potash; (4) superphosphate and potash—these treatments being compared with no manure. Each plot consisted of four trees surrounded by a buffer row, six replications of plots forming a series of randomized blocks.

The variety of trees chosen for the test was "Lisbon" on "Sweet Orange" stock. The trees were planted in the orchard in 1914 (being then two years from the bud), 20 ft. apart on the square. The soil was of a light pumice type, and the area flat except where the land falls away to a depression on the north-east side.

Fertilizers applied.—The following are the quantities of fertilizers which have been applied annually since the commencement of the experiment on the 26th September, 1930 (amounts of fertilizer in

hundredweights per acre) : (1) No manure ; (2) superphosphate, 6 cwt. ; (3) superphosphate, 6 cwt., and sulphate of ammonia, 6 cwt. ; (4) superphosphate, 6 cwt., sulphate of ammonia, 6 cwt., and sulphate of potash, 4 cwt. ; (5) superphosphate, 6 cwt., and sulphate of potash, 4 cwt. The dressings of superphosphate, superphosphate and potash, and potash were divided, half—*i.e.*, 3 cwt. per acre—being applied about September prior to the green crop being ploughed under, and the remainder about March, when the green crop was sown. The application of nitrogen was also divided, one dressing of 3 cwt. per acre being applied in September, and the remainder early in December.

In 1933 it was decided to apply carbonate of lime to those plots receiving sulphate of ammonia, and for every 1 lb. of the latter which had been applied 1½ lb. of lime was given to the appropriate plots. Subsequent applications of sulphate of ammonia have been accompanied by lime dressings at the same rate. This course was taken in order to correct any increase in soil acidity caused by sulphate-of-ammonia applications.

Range of Distribution of Fertilizer Applications.—The fertilizers were distributed evenly over the whole area within the trunk line of buffer trees, with the exception of an area (having a radius of 4 ft.) around each "plot" and "buffer" tree.

Green Manures.—Prior to commencement white lupins had been sown each autumn and disked under in the spring. On the 17th March, 1931, blue lupins were sown at the rate of 2 bushels per acre. Much of the crop where trees were very close became affected with *Ascochyta pisi* and died. The balance of the crop which had made growth was cut up with the disks and very well covered. In the autumn, 1932, oats were sown, and, at the time of ploughing under in the spring had reached a height of 24 in. In 1933 and 1934 no cover-crop was sown, but there was a medium to heavy crop of weeds which was disked under at each spring cultivation.

Crop Yields.—The following table shows the average production per tree and relative yields (no manure = 100) for each treatment for the four twelve-monthly periods since the commencement of the experiments, and also the total production to date.

Average Yield of Uncured Fruit per Tree in Pounds and Relative Production (No Manure = 100).

Period.	Treatments.				
	No Manure.	Super.	Super and Sulphate of Ammonia.	Super, Sulphate of Ammonia, and Potash.	Super and Potash.
15th January, 1931, to 14th November, 1931	145·7 (100)	156·3 (107·3)	212·8 (146·1)	179·8 (123·4)	183·1 (125·7)
14th November, 1931, to 2nd December, 1932	285·8 (100)	326·5 (114·2)	330·6 (115·7)	355·7 (124·5)	344·5 (120·5)
2nd December, 1932, to 15th December, 1933	121·4 (100)	170·9 (140·8)	164·1 (135·2)	200·8 (165·4)	185·2 (152·6)
15th December, 1933, to 18th December, 1934	94·5 (100)	140·2 (148·4)	187·9 (198·8)	197·5 (209·0)	143·1 (151·4)
Total	647·4 (100)	793·9 (122·6)	895·4 (138·3)	933·8 (144·2)	855·9 (132·2)

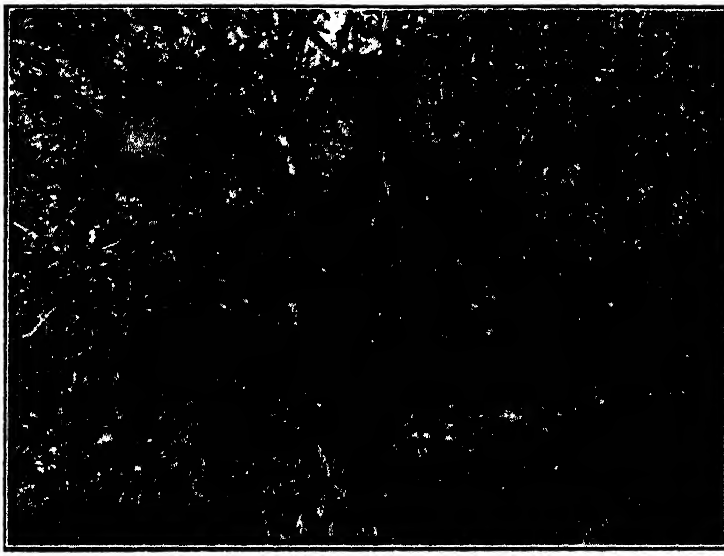

FIG. 1.

Tree in "no manure" plot. Spareness of foliage on this tree as compared with the tree in fig. 2 was typical of that occurring in the "no nitrogen" plots following frosts early in the winter of 1934.

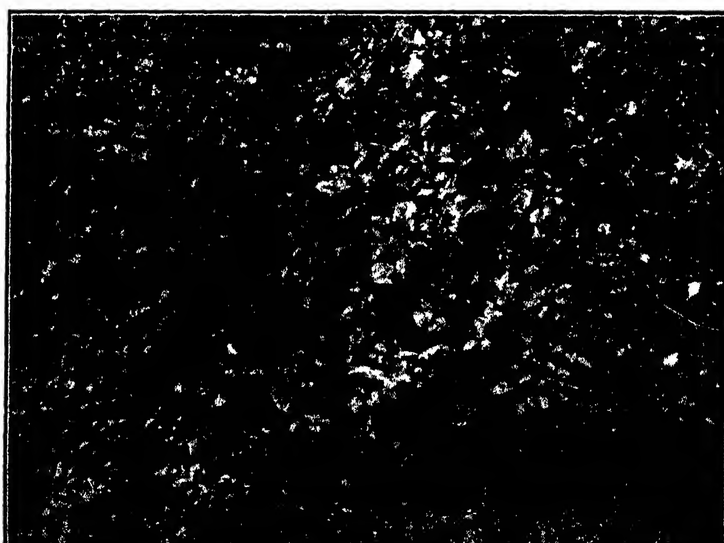

FIG. 2.

Tree on superphosphate plus sulphate of ammonia plot. The condition of this tree was typical of plots receiving nitrogen. Photographs were taken on 24th September, 1934.

The differences recorded during the first three-yearly periods were not statistically significant,* but in the last period (15th December, 1933, to 18th December, 1934) the treatments which included sulphate of ammonia gave significantly higher yields than other treatments. In the winter of 1934 the whole block was affected by frosts, the fruit and young growth being damaged. Prior to the frosts, the trees which had received nitrogen had made much better growth than those without nitrogen, and appeared to be less seriously injured. It seems, therefore, that the differences in yield in the last period may have been accentuated by frost injury.

Curing Data.—The following summary shows curing data since the 9th March, 1931 :—

Weight of Cured Fruit as Percentage of Uncured, Grading, &c., for each Treatment for Period 9th March, 1931, to 6th November, 1934.

Treatments.	Cured Fruit as Percentage of Uncured.*	Percentages of Cured Fruit in various Grades.†			Rejects: Average Number of Fruit per 100 lb. of Uncured Fruit.
		First.	Second.	Third and Fourth.	
(1) No manure	80·2	37·6	43·0	19·4	37·5
(2) Superphosphate	82·2	35·9	43·2	20·9	33·4
(3) Superphosphate and sulphate of ammonia	81·5	38·9	41·9	19·2	36·0
(4) Superphosphate, sulphate of ammonia, and potash	80·1	35·6	43·3	21·1	37·2
(5) Superphosphate and potash ..	79·7	33·5	40·6	25·9	39·3

* Includes green, silver, coloured, and tree ripe. † Includes green, silver, and coloured.

The curing data do not suggest any appreciable differences in quality resulting from the various treatments.

Trunk-circumferences.—The following schedule shows the average trunk-circumference of trees in each treatment in each year, and the average increase in girth recorded in 1934 as compared with 1931 :—

Treatment.	Average Trunk Circumference. (Inches.)				Average Increase, 1934 over 1931.
	1931.	1932.	1933.	1934.	
(1) No manure	25·8	26·8	28·1	29·1	3·3
(2) Superphosphate	26·1	27·0	28·2	29·4	3·3
(3) Superphosphate and sulphate of ammonia	25·7	26·8	28·1	29·1	3·4
(4) Superphosphate, sulphate of ammonia, and potash	26·4	27·2	28·4	29·7	3·3
(5) Superphosphate and potash ..	25·4	26·8	28·2	29·4	4·0

Present Condition of Plots.—The trees of the "no manure" plots are obviously poorer in condition—size, density, colour of foliage, and debilitated lateral growth—than the balance of the plots comprising

* "Statistically significant" means that the chances in favour of the differences being due to manurial treatment and not to chance variation are greater than 30 to 1.

the experiment. Many of the trees in treatments 2 and 5 (which have not received sulphate of ammonia) are slightly better in condition than the trees in the "no manure" plots, but are all inferior to the average of the trees in plots 3 and 4. The difference between the trees in figs. 1 and 2 is typical of the effect obtained on the plots not receiving nitrogen (treatments 1, 2, and 5) as compared with those receiving nitrogen (treatments 3 and 4). During the latter part of the year 1934 it became obvious that the condition of the whole of the experimental block had depreciated since the experiment was laid down, mainly due to bark-blotch, citrus red scale, drought, and frost.

Acknowledgments.

The assistance received from the undermentioned is acknowledged with thanks: Crop Experimentalists, Messrs. A. W. Hudson and J. W. Woodcock, in connection with the planning of the experiment and analysis of data, Messrs. L. M. Estcourt and A. R. Grainger, Orchard Instructors, for supervising the work on plots and in the curing-shed; Messrs. Mayfield Bros. and Tauranga Citrus Growers' Association, Ltd., and staffs, who willingly carried out the great amount of work involved in the orchard and in the curing-store respectively; the Pacific Potash, Ltd., and Imperial Chemical Industries, Ltd., who kindly donated fertilizers; and to the Scientific and Industrial Research Department for supplying funds for other fertilizers and railages.

CONTROL MEASURES AGAINST WORMS IN SHEEP.*

Dudley A. Gill, District Superintendent Live-stock Division, Department of Agriculture, Wellington

Worms in the true stomach and intestines of sheep cause enormous losses, but a great many of the species which seriously affect sheep are ones for which there is no known medicinal treatment. A number of reputed cures for all manner of worms in sheep are being sold, and associated with these reputed cures are wonderful testimonials and guarantees; but the fact remains, nevertheless, that there is no drug or medicine known to be effective against many of the worst offenders. Treatment will be mentioned again later and the fact that many species are not amenable to dosing with medicine is only brought in now in order to stress the importance of knowing the life history of these untreatable worms. Since it is impossible to treat them effectively with medicine, we must try to control them by other means, and we cannot do that unless their life history is known to us.

The worms which cause the most serious losses are various species of round worms, occurring in the fourth stomach and in the intestines. They are called round worms because they are cylindrical in shape and to distinguish them from tape worms, or other flat worms such as the liver-fluke.

In the fourth stomach there are two common varieties—the large stomach worm, which is about ½ in. to 1 in. or more in length, of a

* Portion of a lecturette broadcast from Station 2YA.

reddish brown colour, and with a whitish streak running spirally along its body which gives it the name of "the barber's pole worm," and the small stomach worm which is very fine and small—about ½ in. long—and often overlooked unless searched for with special care, although it may be present in vast numbers. In the small intestine there occur very minute hair-like worms, called *Trichostrongyles*, which are so small as to be found only with difficulty even when thousands are present. Another variety found in the small intestine is a somewhat larger worm, greyish pink in colour and commonly with one end coiled in a spiral form. This type sometimes occurs in tangled masses which may practically fill the gut for a few inches or more. The hook-worm of sheep also occurs in the small intestine. Fortunately, it is common only in some districts, as it is rather a serious parasite. It is easily seen, being fairly stout though only about ¾ in. or so in length. This worm may be seen when the gut is opened, and, in addition, its presence can be surmised easily because its attack on the lining membranes of the intestine causes numerous small red spots of hæmorrhage about the size of a pin's head. One does not find this variety in large numbers like the others.

In the cæcum or blind gut the so-called whip-worm commonly occurs. It is 2 in. or 3 in. long, has a fairly stout, white hinder-end, and attaches itself to the gut-wall by a very thin, hair-like neck - hence the resemblance to a whip. This species is often quite numerous and is easily seen, so that whip-worms often greatly impress the farmer who makes a post-mortem examination on one of his sheep, but actually they do little harm and are found in almost all sheep at some time or another. In the crown and in the hinder part of the gut two other species which may be encountered appear alike to ordinary observation. They are whitish worms about ½ in. to 1 in. long, stout, and easily seen. One of these (*Chabertia*) sometimes causes marked inflammation by biting the lining membrane, and a few of them can do a good deal of damage, since they move about from one place to another, feeding and damaging the gut-wall as they go. Usually they do not cause much loss, but in some cases may result in diarrhœa and straining, and a good deal of loss in condition. The other important worm in the hinder gut is not common in New Zealand, and does not appear to cause losses here, though it is a very serious menace in more tropical countries, where a high summer rainfall provides the conditions of heat and moisture which encourage its propagation.

These are not by any means all the worms occurring in sheep in New Zealand, and it must be understood that where one has mentioned a type such as the tiny *Trichostrongyles* in the small intestine, one refers to a number of closely related species having very similar characters.

In the life history of these worms there is one fact which it seems well to stress, because few farmers realize its significance. It is that worms do not multiply inside the animal. Every worm found inside a sheep has reached it from outside and represents a larval worm taken in by the sheep along with its feed

Of all the worms mentioned the only ones amenable to treatment by medicines or drugs are the large stomach-worm or barber's pole worm, the hook-worm, and, by a special method which has only recently been devised and is not yet widely used, the two species mentioned as occurring in the hinder gut. None of the others can be dealt with

adequately in this way as yet, though all manner of medicines and methods have been carefully tested. Since they cannot be sufficiently overcome inside the sheep by drugs, it is well to consider how they behave outside the animal in order to discover whether it is possible to counteract them during that stage of their lives.

The female worms of any of these species lay numerous eggs, and some of them lay almost incredible numbers. It is fairly common for one female to lay several thousand eggs a day. The eggs are passed out in the fæces, and each one is a potential parasite for sheep. Possibly millions of eggs are passed every day by a badly infested sheep in whose intestine there may be, say, 100,000 female worms each laying several thousand eggs daily.

If all these eggs actually gave rise to worms in the stomach or intestines of other sheep, it would indeed be disastrous, and very few lambs would ever reach their full growth. Fortunately other factors come into play. Sheep are not parasitized by worm eggs until these eggs have gone through stages of development outside the body, a process which takes time during which the parasites are readily destroyed by such conditions as dryness or sunshine.

While the life histories of all the worms mentioned vary in detail, they are all similar in the main essentials, so that a general outline suffices. Under suitable conditions of moisture and warmth the eggs hatch in two or three days and a larva emerges. The larva merely develops a little further and then moults or sheds its outer covering, continues to develop and moults a second time. After the second moult the larva is ready to infect another sheep. The length of time occupied in moulting varies much with the suitability of the conditions—whether it is warm enough and wet enough being the chief considerations. If conditions relative to warmth and moisture are ideal for the parasite, each of the two moults will take two or three days, and if the weather is adverse the moulting will take longer. The important point is that even under ideal conditions for the parasite an egg passed by an infected sheep cannot infect another sheep till it has hatched and gone through two moults—a process that will take at least six or seven days, and generally longer. When the larvæ are going through their first and second moults after hatching they are very readily killed by sunshine and dry conditions; but once past the moulting and at the infective larval stage, as it is called, they are much more resistant and for prolonged periods can lie in wait to be picked up by a suitable host.

This infective stage is, of course, the important one, simply because it is infective.

Weather conditions affect the larvæ in the infective stage, but in rather an indirect way. Curiously enough the infective larva does not feed, and hence the more actively it moves about the quicker it will use up its reserves of energy, and when that has happened it will die. Given suitable conditions it does move quite a lot, as nature seems to have endowed it with habits best calculated to help it find a good home inside a sheep.

If there is enough moisture—even a thin film of dew is sufficient—and mild light, the infective larvæ crawl up grass blades and stay there waiting for a grazing sheep to pick them up. Strong light drives them back to the roots of the grass and to the soil again. They will therefore

crawl up the grass blades mainly in the early morning and evening and at other times of the day in dull weather. At night, as well as in sunshine, they usually descend to the soil, and in dry conditions tend to penetrate the upper layers of soil. It will be understood readily from this that if the weather leads to the larvæ frequently travelling up and down the herbage, they will soon wear themselves out and die, and it is considered that larvæ capable of living quietly for a year or more may die in three months or less if the climatic conditions induce sufficient activity.

What practical advantage can we take of this knowledge of the life history of these parasites? In the first place it indicates the need for very careful sheep-pasture management. It is inadvisable to let sheep-pastures become too long. If pastures become long, more especially in damp localities, they provide just the shelter from sunlight and the drying effects of wind which help the parasites to survive during their more delicate stages. As far as possible it is advisable to move sheep frequently and to have sufficiently small paddocks to be able to do this. If it is possible to move sheep every week or ten days the eggs they have passed during that period will not have had time to reach the infective stage, and by the time the parasites reach the infective stage there will be no sheep present to infect. If there are swampy areas or lagoons from which the sheep drink, it is advisable either to drain them or to fence them off. Such areas, because they offer conditions suitable to the parasites, and because sheep frequent them for water, are apt to be heavily infected. Where possible it is well to let cattle graze the paddocks ahead of the sheep. There are two very sound reasons for this. In the first place the cattle eat out the longer feed, leaving more suitable grazing for the sheep which follow. Secondly, the cattle remove many infective larvæ of parasites which infect sheep: sheep-parasites, with the exception of the large stomach-worm, do not infect cattle, and such as are eaten by cattle will be destroyed. Lambs and hoggets should be allowed to graze ahead of older sheep. Most sheep have an appreciable number of parasites in their intestines, and consequently are passing eggs, but with age the animal develops resistance against the adverse effects of worms. It is the lamb and the hogget which are most affected, and hence they should always be given the first chance at a clean "break" of feed. Such eggs as lambs and hoggets pass do not harm the ewes which follow them much, but ewes that appear quite healthy may yet pass sufficient eggs to infect seriously hoggets or lambs coming after them.

That sheep acquire a resistance to parasites with age is a statement that needs a little explanation. It is not their age which gives them resistance—they have acquired the ability to resist worm-infestation through having been infested and having overcome the infestation in their earlier days. The matter has been investigated a good deal, and definite information obtained. A satisfactory indication of the number of worms harboured by a given sheep can be obtained by counting, with the aid of a microscope, the number of eggs it is passing. It is found that if a sheep known to be free of a certain species of worm is deliberately fed with infective larvæ, eggs begin to appear in its droppings after a time—usually about three weeks. These eggs increase in numbers for a time, and then quickly fall off, till very few are passed. Once a sheep has gone through such an infestation it is

difficult to reinfect it with the same species of worm. Having had experience of that particular worm the animal has somehow found ability to overcome it and to resist further attacks. But there are two very important points to note about this. Firstly, the parasite seldom is completely overcome, and usually the sheep tolerates a few —hence the almost universal finding of various species of worms in older sheep which appear in perfect health. Secondly, the resistance that the sheep has acquired is not very strong, and is easily broken down, especially by undernourishment. That is why good feeding is such a very important factor in the control of worms, not only in sheep, but in any animal. The poorly fed lambs and hoggets readily fall victims of parasites where well-fed ones may pick up just as many infective larvæ and suffer comparatively little. Lambs and hoggets are more seriously affected than older sheep, partly because, owing to their youth, they have as yet had no chance to acquire resistance and partly because food-shortage or deficiency tells more heavily on the young growing animal than on the adult. Adult sheep are by no means immune to serious worm-infestations; in fact ewes, wethers, and rams are not uncommonly lost through it, but when this happens one finds two factors responsible—poor feed conditions, and circumstances which lead to a heavy intake of infective larvæ. Such facts may suffice both to explain and to stress the enormous importance of good feed, not only for the prevention of loss from parasites, but also in the treatment of affected sheep.

Lastly, there are some points about the treatment of sheep for parasites which seem to need emphasizing.

So far as worm drenches for sheep are concerned the choice of effective and practicable drugs is very limited. Omitting such things as lysol, which is not often used for sheep and has no particular advantage, one is left with the following: (i) Copper sulphate (either by itself, or mixed with arsenic or mixed with nicotine sulphate (Black Leaf 40)); (ii) carbon tetrachloride and tetrachlorethylene.

The doses of these to use may be obtained from the local veterinarian or stock inspector. The question is which of these things to choose.

If sheep are infected by fluke or hook-worm, it is advisable to use carbon tetrachloride, which is effective, whereas copper sulphate, arsenic, and nicotine are useless. Extract of male fern is effective against fluke but is too expensive.

If tape-worms are present, a mixture of copper sulphate and nicotine sulphate (Black Leaf 40) should be used.

The usual purpose of drenching sheep, however, is the control of the large stomach-worm, to deal with which any of the drugs or mixtures mentioned may be relied on: but copper sulphate is just as effective as any of them, and it is very much cheaper.

Whereas it was always advised to starve sheep for twelve hours or so before drenching with copper sulphate, it is now known that this is quite unnecessary. The results are just as good if the sheep are brought in and dosed straight away. Such a practice is much handier for the farmer and is much less of a strain on the sheep, especially if they are already weakened by the attacks of the parasite.

It is sometimes difficult to convince a farmer that his sheep are suffering from stomach-worm if they are not scouring. The large

stomach-worm does not cause scouring, which usually is due to the smaller worms farther down the intestine Some of these, as well as large stomach-worms, are usually present, but if the latter are present almost alone, as they sometimes are, there is generally no scouring at all. The animal merely becomes weak and very anæmic and may die if not treated in time.

Since the large stomach-worm, against which copper sulphate is effective, is usually only one of several varieties of worm infesting the sheep, it may be asked what use is served by clearing out that one and leaving all the others against which copper sulphate is practically useless. The answer to that is that if the large stomach-worms are overcome and the animal is put on better and more strengthening feed, the decrease in stomach worms and the better feeding together, generally enable the animal to fight a successful battle against the other species affecting it.

There are instances, however, where heavy losses from intestinal worms occur and where copper sulphate is ineffective because the large stomach-worm is not involved, and the worms responsible are not amenable to that treatment. It is in such cases that good feeding and proper management in the light of the information given herein concerning the life history of such worms play so large a part in their control.

As has been said, the small stomach-worm and most of the intestinal worms of sheep have resisted all methods of treatment with drugs. Recently, however, there has been some grounds for hope that a solution of the difficulty may be within sight. A brief explanation of this should prove of interest.

The effectiveness of copper sulphate, and the ability to dispense with starving the sheep before giving it, are due largely to the fact that this drench almost always passes straight into the abomasum or true stomach, whereas most other worm-medicines are apt to pass into the rumen or paunch. This was first observed by Dr. Clunies Ross, a well-known veterinary parasitologist in Australia, and it may well have far-reaching effects, as it offers a new line of attack against the species which so far have resisted treatment.

One of the main difficulties in treating such cases has been that the drugs used could not be brought within striking distance, as it were, of the worms. It may now be possible, by combining suitable drugs with copper sulphate, to convey them straight into the abomasum and thus avoid their being side-tracked in the rumen. There are already some observations, recorded by Dr. Clunies Ross and his colleagues, that a combination of copper sulphate and nicotine sulphate (Black Leaf 40) has a distinct effect on *Trichostrongyles* in the small intestines of sheep—parasites which have been regarded previously as being among the most difficult to deal with.

Much further work is needed before it can be stated confidently that a reliable method of treatment has been found, but research on these lines is being pushed on with in institutions specially equipped for such purposes, and it can be said that the position to-day is more hopeful than it has ever been in the past.

THE IDENTIFICATION AND PURCHASE OF CERTIFIED SEED POTATOES.

MOST potato-growers are aware of the differences between Government certified seed potatoes and uncertified seed potatoes, and the benefits that are to be derived from the use of the former when planting their crops. From information obtained from time to time by the officers of the Department of Agriculture, however, it would appear that many purchasers of seed potatoes are not aware of the means of identification of Government certified seed. It is the intention of this statement to draw the attention of purchasers to the ways in which they may be sure of receiving the genuine article.

Firstly, then, the certification of seed potatoes may be divided into two stages. The former commences with the entry of the grower's crop into certification at or before the time he actually plants his crop. It continues through the growing period, and includes the field inspection of the crop when in full growth to determine the percentage of foreign varieties and virus-diseased plants which may be present. This stage concludes before the crop is dug, and upon the inspections made and information gained certain crops are rejected, while others are classed into "Mother" or "Commercial" according to quality, and further sub-classed into numbered groups. This classing of crops is known as "Provisional Certification."

To the growers of all crops accepted at this stage publicity in the Department's *Journal* is given, and provisional certificates are issued indicating that the crop "has been found to be sufficiently vigorous and free from foreign varieties to warrant the issue of this provisional certificate." This certificate further states, "This is not a final certificate, and the grower is not entitled to sell his seed as certified seed until such time as his graded produce has been inspected . . ."

A provisionally certified crop, therefore, is one which has reached the standards in regard to the inspection of the growing plants but the produce from which has not yet been inspected to determine the standard of freedom from diseased and damaged tubers, grading according to size, &c.

The second stage in potato-certification covers the inspection of the produce harvested from a provisionally certified crop to see that the tubers comply with the standards set in regard to freedom from diseased and damaged tubers, grade, &c., and the issue of tags to attach to the sacks of any produce which complies with these standards. Thus, when a grower of a provisionally certified crop has a portion or the whole of his produce graded and in sacks ready for sale, he communicates with the local Instructor in Agriculture. The Instructor inspects the produce, and, if it complies with the standards set, prepares and signs sufficient tags to attach one to each sack passed, and issues them to the grower. The grower attaches a tag to each sack passed, countersigning it to the effect that he guarantees the contents of the sack to be tubers harvested from his provisionally certified crop, and to have been passed by the Instructor as indicated on the reverse side of the tag. This completes the final certification of a particular line of potatoes, but covers only the produce inspected at that stage, and does not include produce which is later to be graded and sorted.

The two stages may be summarized as follows :—

(1) Provisional certification, which covers the field inspection of the crop.

(2) Final certification, which covers the tuber inspection of the produce of a provisionally certified crop.

While a grower is perfectly entitled to sell his produce at the provisionally certified stage, and is not compelled to have it finally certified, there is no way of identifying provisionally certified seed other than by taking the word of the vendor.

Every sack of finally certified seed, on the other hand, has attached to it a certification tag signed by the Instructor and countersigned by the grower. This is the purchaser's official identification mark for certified seed, and any purchaser stipulating certified seed who receives seed without a tag attached to each sack is entitled to refuse acceptance of such seed on the ground that it is not finally certified. Tags are occasionally lost in transit, of course, but any line which has not a certification label attached to every sack should be accepted reservedly, while a line with only a few sacks tagged should not be accepted as certified seed under any conditions.

The purchasers of small lines of less than a sack of seed potatoes are in a less fortunate position in regard to the identification of the material they are purchasing. At least, they have been in that position, but the Department of Agriculture is now prepared, subject to certain conditions, to finally certify potatoes packed in crates containing 14 lb., 28 lb., or 56 lb. of tubers. Such crates are of standard pattern, bearing a special certification sticker on one end, and sealed with string and a certification seal in such a manner that the crate cannot be opened without breaking the string Thus purchasers of small lots have it in their own hands to be sure of obtaining certified seed potatoes. At the present time the supply of crated potatoes is not great, and difficulty may be experienced in obtaining them. The supply, however, is limited only by the demand, and as the demand increases so will vendors find it worth their while to stock crates of certified seed.

—*J. H. Claridge, Certification Officer.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 11th July, 1935, to 25th July, 1935, include the following of agricultural interest :—

No. 72861 : Shearing-machine-comb cleaner ; E H Smith. No 73964 : Tine-harrow unit ; R. M. Wilson. No. 73388 : Teat-cup , A W. Stewart No. 73470 : Harrow ; H. V. McKay Massey Harris Pty., Ltd. No 74007 : Incubator ; R. Harrison. No. 74039 : Plough-wheel centre ; A. C Anderson. No. 74040 : Agricultural implement ; A. C. Anderson. No. 74110 : Honey-cappings melter ; J. F. G. Roberts. No. 74111 : Melting and reconditioning honey ; J. F. G. Roberts.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

Erratum.

The titles to the illustrations on page 35 of the July *Journal* were transposed.

THE WHITE BUTTERFLY MENACE.

EFFICIENT CONTROL BY THE PUPAL PARASITE, *PTEROMALUS PUPARUM.*

J. MUGGERIDGE, Entomologist, Plant Research Station, Palmerston North.

It is known generally that the white butterfly first made its appearance in Hawke's Bay in 1930 and by 1933 was to be seen in millions flying over the road-sides and pastures, and as a white fluttering cloud over every cruciferous crop in and around Hastings.

In 1933 the first pupal parasites (see this *Journal*, September, 1933) were liberated and the following account of their activities augurs well for the future control of the pest.

In 1933 10,812 parasites were liberated at Maraekakaho, Hawke's Bay, and in a subsequent examination of 415 butterfly pupæ collected there, 58 per cent. were found to be parasitized; this not only ensured their destruction, but indicated the probability of an increase in the parasite.

In 1934 there was a noticeable reduction in butterflies around Maraekakaho, but elsewhere they increased and spread; therefore additional parasites were liberated in this centre. Later in the same year, 90 per cent. of 5,000 butterfly pupæ collected much farther afield than the original place of liberation proved to be parasitized, and the parasite had then spread over hundreds of square miles, extending as far as Alfredton, a distance of eighty-two miles.

During the past season—*i.e.*, 1934-35—the pest virtually was brought under control in Hawke's Bay, and pupæ, which were very difficult to find, were heavily parasitized.

Parallel events have occurred in the Manawatu—a small supply of parasites having been liberated in 1934 resulted in 14 per cent. of the pupæ collected being parasitized. At points outside of where the parasites were liberated 19,567 pupæ were collected, and none of these was parasitized.

During 1934-35, butterflies were very prevalent in the Manawatu-Marton district, but the parasites already liberated were equal to the occasion, and of 21,881 butterfly pupæ collected this past winter of 1935, no less than 20,940, or 96 per cent., were found to be parasitized.

No doubt the white butterfly will always be with us, but the parasite has checked effectively the widespread ruin that inevitably would have occurred in the most important of our forage crops—the brassicas.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING JULY, 1935.

Appended is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements that published in the July *Journal*, and refers to those crops passed during July. Further tests will be published in later issues.

In the May *Journal* was published a list of growers who have received provisional certificates. The acreage, percentage of foreign varieties present, and the classification and group number representing the relative merits of lines were given in the list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—

Amor, A. W., Woodend (Line A)
Amor, A. W., Woodend (Line B)
Amor, A. W., Woodend (Line C).
Anderson's Estate, Lincoln (Line B)
Anderson's Estate, Lincoln (Line C).
Crump, F., Springston, R.M.D. (Line A).
Dyer, H., Southbrook
Eder, W., Sefton, R.M.D. (Line A).
Ferguson, J. W., R.M.D., Winchmore.
Franks, L. J., 88 Russley Road, Christchurch
Guy, T. A. and E. B., Yaldhurst
Jellie, J., Russley Road, Upper Riccarton, Christchurch.
Johnston, R. H., Dunsandel.
Kavanagh, D., 50 Ryan's Road, Upper Riccarton, Christchurch
Marshall, D., Killinchy - Leeston, R.M.D.
Martin, W. E., Kaiapoi, R.M.D. (Line A).
Mulcock, W. J., Ryan's Road, Upper Riccarton, Christchurch.
Nicklaus, J. F., 104 Ryan's Road, Upper Fendalton, Christchurch.
Prebble, R. L., Springston, R.M.D.
Prosser, L. W., Leeston, R.M.D.
Rathgen, A. E., Killinchy - Leeston, R.M.D.
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch.
Rolston, G., Weedon's - Greendale, R.M.D.
Roper, P. F., Halkett, R.M.D.
Seaton Bros., Courtenay, R.M.D.
Smith, E. A., Springston, R.M.D. (Line B).
Stewart, A., Marsh's Road, Templeton.
Swanson, W., Selwyn
Ward, C. R. T., Ladbrook's
Weeber, H., Englefield Road, Belfast (Line A).
Wilson Bros., Halkett, R.M.D. (Line A).
Wilson Bros., Halkett, R.M.D. (Line B).
Wilson, M., Halkett, R.M.D.
Wilson, W. A., Halkett, R.M.D.
Wolff, R. G., Horrelville, R.M.D.
Wright, Q. A., Annat.

Commercial Seed—

Ballantyne, C. T., Gleniti, Timaru.
Couper, R. P., Washdyke, Timaru.
Eder, W., Sefton, R.M.D. (Line B).
Gaffeney, Mrs. M. F., Arowhenua, Temuka.
Gray, R., St. Andrews (Line B).
Hastie. A. W., Pareora, Timaru.
Musson, W. R., Rangiora.
Oliver, J. O. J., Factory Road, Temuka (Line A).

AUCKLANDER SHORT TOP—*continued.*

Commercial Seed—continued.

Oliver, Mrs. Z. M., Temuka.
Proudlock, A., East Eyreton - Kaiapoi, R.M.D. (Line B)
Reynolds, H., Watson's Road, Harewood.
Saunders, W., Clandeboye, Temuka.
Smith, R. S., "Beach Farm," St. Andrews
Topham, J. W., Arowhenua, Temuka.
Traves, H., Levels, South Canterbury.

DAKOTA.

Mother Seed—

Burrowes, J., Chertsey, Mid-Canterbury (Line A).
Chambers, R., Rolleston.
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line A)
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line B)
Gardiner, O. J., Dunsandel.
Hooper, R. M., Mitcham, via Rakaia (Line A).
McPhail, W. A., Mitcham, via Rakaia (Line A).
Steele, J., Kimberley, R.M.D. (Line A)
Walker, C. E., Estate of, West Melton, R.M.D.
Williams, J. W., Halswell
Wilson, M., Halkett, R.M.D. (Line B)

Commercial Seed—

Steele, J., Kimberley, R.M.D. (Line B).

ARRAN CHIEF.

Mother Seed—

Batchelor, R. S., Waimate.
Bennett, J., jun., Papatotara, R.M.D.
Boyce, W. J., Waituna, Waimate.
Daly, P. G., Te Waewae.
Griffin, J. G., Te Waewae.
Knowler. H., Te Waewae.
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch (Line B).
Saunders, E. E., Studholme Junction (Line B).
Smith, W. J. M., Seadown, Timaru.
Teschner, C. A., Knapdale, R.M.D., Gore.

Commercial Seed—

Beckingsale, J. H., Clearview Settlement, Herbert.
McCarthy, E., Prebbleton (Line A).

ARRAN BANNER.

Mother Seed—

Robinson, R. G., Ltd., Box 4, Papanui, Christchurch.
Sheddan, G. B., Otahuti, R.M.D. (Line A).
Wilson, C. H., Lorneville, Invercargill.

ARRAN BANNER—*continued.*

Commercial Seed—
Harvey, W., Mosgiel.
Robinson, D. B., Waikuku.
Sheddan, G. B., Otahuti, R.M.D. (Line B).
Smith, C. R., Bushy, R.M.D., Palmerston South.

KING EDWARD.

Mother Seed—
Griffin, J. G., Te Waewae.
Mehrtens, L. C., Box 27, Tuatapere.

Commercial Seed—
Kenny, J., Mosgiel
Marshall, W., and Sons, Outram (Line A)
Marshall, W., and Sons, Outram (Line B).

AUCKLANDER TALL TOP.

Mother Seed—
Court, R. T., R.M.D., Swannanoa (Line A).
Eder, W., Sefton, R.M.D.
Guy, T. A. and E. B., Yaldhurst
Steele, F., Fernside, Rangiora (Line A).
Steele, F., Fernside, Rangiora (Line B).
Steele, F., Fernside, Rangiora (Line C).

AUCKLANDER TALL TOP—*continued.*

Commercial Seed—
Court, R. T., Swannanoa, R.M.D. (Line C).

EARLY ROSE.

Mother Seed—
Burns, R. A. C., Te Pirita, R.M.D., Rakaia

EPICURE.

Mother Seed—
Burgess, D., West Plains, Invercargill.
Robinson, R. G., Ltd., Box 4, Papanui, Christchurch.
Wright, L. T., Annat

JERSEY BENNES

Mother Seed—
Penn, T. A., 154 Innes Road, Christchurch (Line A).

EARLY REGENT BOLTER.

Mother Seed—
Pascoe, S., Halkett, R.M.D.

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

The Coming Month.

As a rule, September is an embarrassingly busy month for the efficient farmer. Indeed, farmers who are not desirous of doing more work in September than they can hope to accomplish with convenience are probably either very fortunate in being well ahead with their farm operations or remiss in respect to some jobs that profitably would repay attention. Many successful farmers follow three rules in regard to September work: Firstly, they make use of every hour in which it is practicable to work, secondly, despite their eagerness to make seasonable progress, they carefully abstain from doing any class of work which would be better undone because of wet conditions; and, thirdly, when faced with a greater amount of work than can be carried out at once with the labour available they exercise sound judgment in discriminating between tasks which can be deferred without serious consequences and tasks which in the interests of a reasonable standard of efficiency must receive attention without delay. Indeed, reliable evidence of good management is deciding what jobs are essential at a particular time, doing them at that time and leaving undone for the present other jobs which must be done later but which do not call so urgently for attention. Though this may seem an obvious simple fact it is disregarded so much in practice that one of the greatest causes of waste in farming is expenditure of labour and material on work carried out at an unsuitable time. The condition of the seed-bed and the sowing date, which are important factors in success with crops, are dependent to a large extent on the time at which preparatory cultivation is carried out, and it is chiefly because of this that September field-work is of such great moment.

Management of Spring-sown Crops.

Valuable guidance relative to the management of spring-sown crops is provided in the following statement in which Russell, of Rothamsted, summarizes the available knowledge —

"Most spring-sown crops take up practically all the nitrogen, phosphate, and potash that they need within the first five or six weeks of growth; material taken up later is of much less value and may even be harmful." New Zealand trials and general field experience accord fully with this.

One of the deductions from the statement is that the seed-bed is of basic importance and calls for preparatory cultivation, ample and early enough to give the maximum supply of readily available plant-food material, a result which is obtained most economically by the weathering processes which appropriate cultivation facilitates. Over many years extensive examination of crop results shows that constant cultivation is the essential basis of fully satisfactory results from manures, seeds, and land.

Another deduction from the fact that certain crops take most of their food from the soil while quite young is that any fertilizer supplied should be such that the crop can use it readily. This, generally, may be secured not only by supplying substances which are readily available, such as superphosphate, but also by supplying them in a place readily accessible to the crop. This means that it must be in the vicinity of the youthful root-system of the crop. Hence, provided seedling-injury is avoided, placing artificial fertilizer in the drills should be more effective than broadcasting it all over the soil, and trials show that as a rule this is the case. As phosphatic fertilizers normally are of greatest importance in New Zealand cropping it is of moment

that while the young crops need their phosphate right from the start there is variation in the ease with which they can obtain the phosphorus from relatively insoluble compounds. According to overseas investigations, swedes, turnips, and lucerne have greater ability than cereals and potatoes to obtain phosphorus from relatively insoluble phosphates. This is in accordance with New Zealand experience and assists in explaining, for instance, the satisfactory results that have been obtained in Southland from root-crop manures which contained considerable amounts of insoluble phosphates the assimilation of which is favoured by plentiful supplies of moisture. In dry regions in which similarly good results are not given by the insoluble phosphates field trials point to the advisability of using quickly-acting phosphates with turnips, provided suitable precautions are taken to avoid injury of seedlings by contact with soluble fertilizing material.

Even though turnips and lucerne are better able than other spring-sown crops to obtain phosphorus from relatively insoluble phosphates it does not follow that such phosphates should be the exclusive phosphatic constituent of manures for turnips and lucerne, which consistently benefit distinctly from the immediate stimulation of growth which results from the use of superphosphate, possibly in conjunction with more slowly acting phosphates. To sum up, the young plants of spring-sown crops need phosphate right from the start, and thus calls for the use of at least some superphosphate, and, as a rule, the use of superphosphate to the exclusion of other phosphates is followed by quite satisfactory results.

A particularly high standard of fertility is reflected profitably in the yields of crops capable of such heavy production as the mangel and chou moellier As a result, it often proves well worth while to supplement the liberal use of artificial fertilizers by dressings of animal-manure from stock yards, &c., or of decayed crop remains, such as are provided by stack bottoms--such dressings should be scattered as uniformly as possible in good time to allow of their becoming well incorporated in the soil by the time the young crop is exploring the soil for food material.

Special Crops for Winter Use.

One of the major objectives of spring field-work should be the provision of feed for use in the following winter. For this purpose the mangel is one of the most valuable crops except for use in the more severe southern districts. When the fertility and cultivation are both good, mangels are characterized by excellent yields ; but unless there is assurance that mangels are to receive good treatment their culture is not advisable The position, briefly, is that good treatment of mangels ensures good results, but indifferent treatment may beget not indifferent, but poor crops The marked and valuable reliability of mangels under good treatment is due partly to their general freedom from attacks of any serious diseases or pests and partly to their ability to withstand dry periods relatively well—their tolerance of conditions dry enough to affect injuriously some other important crops is indicated by the exceptionally heavy crops of mangels which were obtained last season in districts such as the Manawatu, which experienced an abnormally dry summer. Despite this, a Manawatu record average yield of over 80 tons an acre was obtained in respect to thirty-two crops. Occasionally mangels are attacked by a rot which persists in the soil ; the first attack usually is slight but if mangels are grown again immediately after such an attack a heavy percentage of the plants may be destroyed either in the seedling-stage or when the roots have attained a considerable size. No satisfactory means of treating an attacked crop is known.

Swedes, and, in the severer southern climates, turnips, may often suitably be used instead of mangels, and this especially on fairly extensive farms where there is any uncertainty about being able to provide the good treatment desirable for mangels. Carrots are favoured by free, fertile

soils on which, as Taranaki results have shown for years, really profitable yields can be obtained without an excessive amount of labour, especially if the Guerande variety is grown.

The popularity of chou moellier, sometimes called marrow-stem kale, rightly continues. Chou moellier calls for good ground of the class from which a good crop of cabbage reasonably could be expected. Land which naturally is not of sufficiently high fertility to give attractive crops may be made suitable by additions of animal-manure and similar materials, especially when these are supplemented by artificial fertilizers. Chou moellier proves especially valuable on good ground that is prone to be so wet at the time of feeding-off as to make it difficult to avoid waste in the use of swedes. Chou moellier is at times particularly valuable because it is markedly resistant to club-root, though it does not possess complete immunity.

Special Crops for Summer Use.

Frequently pastures yield unsatisfactory direct supplies of feed from about Christmas or New Year right through to March. Often some attempt is made to cater for the needs of the February-March portion of this period, but many farmers seem not to recognize that it is profitable to make special provision to supplement the pastures during January. Normally the summer feed directly available from pastures more often is deficient in quality rather than inadequate in quantity—frequently it is too woody or fibrous, too indigestible, and too poor in mineral matter, three faulty features which may be summed up by saying that too mature a stage of growth has been reached by the herbage. The remedy is the provision of non-woody feed. Soft turnips are of outstanding value for this purpose as they are highly digestible if not allowed to become overmature and there normally is plenty of opportunity to utilize the crop before overmaturity develops—in this they excel the other crops available. Another crop that, rightly, is widely grown for summer use is rape, which is of outstanding value for the fattening of lambs when the needs of these cannot be supplied by the pastures. In the warmer districts green maize and millet are of value for summer use provided they are utilized when in a young leafy stage.

The amount of special leafy or non-woody feed needed in summer may be lessened appreciably by keeping the pastures themselves in a leafy condition by such practices as ensilage and rotational grazing, which assist in avoiding the development of flowering stalks in pasture-plants; but in dairying, at least, grazing-management, even though it be fully efficient, frequently will not rectify completely the summer shortage of the non-woody type of feed required for heavy milk-production.

Lucerne.

A vigorous stand of lucerne is so valuable and so widely obtainable that increased attention could well be given this season to the establishment of lucerne. While profitable results with lucerne are being obtained over a wide range of conditions of soil and climate the most highly productive crops occur, as a rule, on distinctly fertile soils. The outstanding merits of lucerne well warrant allotting a fertile area to it, yet at times attempts are made to grow lucerne on areas on which it has not been found possible to grow any other crop satisfactorily. As the success which attends the establishment of lucerne depends to a considerable extent upon the initial steps, these should be based upon the latest knowledge available. Much information about lucerne-culture is provided in Bulletin 155, obtainable on application from the Department of Agriculture.

General Considerations regarding Cropping.

By planning to produce reserves of feed in excess of prospective requirements one is likely to be in a better position to face unexpected crop-failures.

It is a serious matter to be short of feed at critical periods ; and, on the other hand, a surplus of feed ordinarily never need be wasted, while it may enable exceptionally advantageous market opportunities to be grasped.

In planning the cropping programme provision should be made for the requirements not only of the main class of stock on the farm, but also of less-important classes, such as pigs and poultry on dairy-farms, and these together with cows on farms devoted dominantly to grain or sheep. The poor returns often obtained from cows, poultry, and pigs kept as side-lines frequently are due primarily to poor feeding. Judicious extension of the programme of arable cropping commonly is a very economical means of improving such poor feeding.

In the case of high-priced land, low cost of production of feed by special cropping is almost always linked with heavy yields per acre secured by really good treatment of a relatively small area. Hence on high-priced land there is special need for thorough cultivation, without which good seed and manures are likely to be wasted to some extent.

Preparatory cultivation for such crops as lucerne, mangels, and potatoes should be undertaken in September if it has not been commenced already. The potato thrives in a loose rather than in a compacted soil. When the cereal-sowing has been carried out the teams may well be kept busy on land for rape and root crops. By cultivating such land in good time one most easily secures the desirable type of seed-bed—that fine from the bottom upwards, as distinct from that consisting of a fine surface layer of soil underlain by hard lumps, which is the type of seed-bed likely to be obtained when cultivation is late and hurried.

Fields for Silage and Hay.

Pastures intended for silage or hay should be eaten off evenly and closed up as soon as they can be spared from grazing. Early closing is valuable because it increases the possibility of early mowing, which in its turn gives greater probability of a good aftermath that is generally very useful with the advent of the customary summer shortage of non-woody feed. A dressing with superphosphate at closing-up of fields for ensilage or haymaking is usually profitable if such fields have not been top-dressed recently. Wire, timber, &c., likely to cause delays or breakages in mowing should be removed carefully from fields prior to closing them up.

September is often also a suitable time to close up lucerne areas for an early cut, which is suitably saved as silage. An early cut is especially valuable when it gives a setback to plants which harmfully invade the lucerne in the winter and spring and which the lucerne is able to outgrow, and thereby suppress, when the cold conditions of winter and spring are past. A general result of early closing of lucerne and consequent conservation of the first cut as silage is an additional cut annually from the lucerne area.

Utilization of Feed.

If pastures damaged by grass-grubs are not affected so seriously as to be beyond repair, then as far as practicable the feeding-out of hay, silage, and roots should be concentrated on them. On the other hand, if the majority of the valuable plants in the pasture have been destroyed by the grubs, then the best course almost always is to put the land under the plough. In planning the cropping of such land it should be remembered that grass or cereal crops cannot with safety follow a grass or cereal crop which was attacked by the grass-grub.

The feeding of stock wholly or largely on roots, which generally is inadvisable, is especially so in August and September, and when persisted in at this time has led to disorders in stock. The roots should, if possible, be supplemented by hay or chaff.

The Pastures.

Over a wide range of conditions pastures often may be sown successfully in September. Generally the most successful establishment is obtained when the pasture is not sown with a companion crop. Permanent pastures especially should be freed from the injurious competition of companion crops. When companion crops are deemed advisable the injurious competition may be lessened by the use of lighter seedings of the companion crops. When cereals are grown as companion crops the period of competition may be shortened by harvesting the cereals for silage or chaff.

The use of suitable mixtures of pasture seeds is of basic importance. Some detailed information about mixtures was given in these notes in the February, 1934, *Journal*. Further information is available from district officers of the Fields Division

It is probable that the coming of September will find some pastures still in need of harrowing. Usually it is very advisable to harrow without delay pastures in which stock have been fed during the winter. In particular, fields intended for ensilage or haymaking during the coming season should be harrowed thoroughly a short time prior to closing them from grazing.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Control of Pests and Diseases.

STONE-FRUIT trees should by this time have been sprayed for the control of leaf-curl and other fungous diseases as recommended in the July notes. In addition to these sprays a further pre-blossom application is necessary should the season prove favourable to brown-rot development. Lime-sulphur at a dilution of 0·1 per cent. applied when the majority of buds are at the pink stage is recommended at this period. At the petal-fall stage apply lime-sulphur 0·083 per cent., plus colloidal sulphur (2 lb. to 100 gallons spray). Subsequently the spray-applications needed are governed by local conditions, variety, &c. Under certain adverse conditions it is necessary to repeat the petal-fall spray at intervals of three weeks until the earliest fruits are almost ready for picking. Under more favourable conditions two post-blossom sprays only are required, the first four weeks prior to the anticipated first picking and the second three weeks later.

Pome-fruit trees, if not already sprayed with oil emulsion as recommended in the previous month, should receive this insecticide at an early date and prior to the green-tip stage. Fungicidal sprays necessary prior to the petal-fall stage vary appreciably according to local conditions. The susceptibility of varieties to powdery-mildew and black-spot, prevailing weather conditions, and tender foliage varieties are the principal governing factors. Varieties that are immune, or almost immune, from attack by powdery-mildew should be sprayed with Bordeaux mixture at a strength of 5–4–50 at the green-tip stage: for other varieties lime-sulphur at a dilution of 0·5 per cent. is preferable. This spray should be followed at the tight-cluster stage with an application of lime-sulphur 0·2 per cent., and at the pink stage or advanced open-cluster stage at 0·1 per cent. In certain localities and on varieties not usually infected with powdery-mildew, the tight cluster spray may be omitted, provided there is no danger of early infection of black-spot. The petal-fall spray, which is probably the most important spray of the year, should be applied when not more than 75 per cent. of the blossom-petals have fallen, and on varieties subject to attack by

powdery-mildew when about 50 per cent. of the petals have fallen. This spray should consist of lime-sulphur 0·1 per cent., plus colloidal sulphur 2 lb. per 100 gallons of spray, plus lead arsenate 1½ lb., plus hydrated lime 4½ lb. per 100 gallons.

On pears, excepting for a few tender varieties, Bordeaux mixture at a strength of 3-4-50 is recommended at the tight-cluster spray and all subsequent sprays.

The dilution of lime-sulphur as given above is shown in terms of the polysulphide-content. The percentage of polysulphide in different brands of lime-sulphur varies appreciably. Consequently a table of dilutions is necessary, and copies of this table are obtainable free from all Orchard Instructors. When a lime-sulphur that contains 15 per cent. of polysulphide is used the empirical formula for the dilutions in general use are as follows: 0·5 per cent. = 1–28; 0·2 per cent. = 1–70; 0·1 per cent. = 1-140; 0·083 per cent. = 1–178.

In mixing lead arsenate with sulphur sprays it is important that the correct method should be followed. Faulty mixing of these ingredients not only is liable to cause severe spray injury but also impairs the efficiency of the mixture as a fungicide. In mixing, first dilute the sulphur fully, to the required quantity of lead arsenate add three times its weight of hydrated lime, mix with water to form a thin paste, and pour into the diluted sulphur solution with the agitator working.

Cultivation.

In orchards that have not as yet been ploughed, this work should be proceeded with without further delay and the ground brought to a fine tilth. Early and thorough cultivation is an important factor in promoting healthy tree growth. Trees should be dug around and all decayed leaves, &c., buried, if possible, before the trees commence growth.

Miscellaneous.

The planting of young trees and the pruning of all deciduous trees should be completed by the end of August. Prunings should be burned before tree-growth commences, since certain diseases can spread from the prunings to infest the young growth.

Adequate support for the fruiting-limbs of mature trees is a matter that requires frequent attention. A permanent system of wire-bracing is recommended, and, if possible, should be completed while the trees are in a dormant state. Full details of a system of central wire-bracing fruit-trees appeared in this *Journal*, November, 1932. While it may not be possible to complete the wire-bracing of all trees in an orchard in any one year, an effort should be made to wire at least a portion of the orchard each year, so that ultimately the objectionable and expensive props no longer will be required.

—*P. Everett, Orchard Instructor, Gisborne*

Citrus Notes.

Owing to the showery and spring-like conditions obtaining during the autumn, a fair amount of young growth which was produced in many citrus orchards had no time to harden before the winter set in. It is possible that some of this growth may be damaged by frost, and it will not be wise to cut such parts back until all danger of frost is over. However, the work should not be unduly delayed, as dead or dying wood is always more or less injurious to any growing trees.

A careful watch should be kept for any indication of borer, and all cavities should be treated with an injection of benzine, and afterwards

the hole should be blocked with soap or some other plastic material. If only small branches are infected it may be more advisable to cut them out and burn.

The coming month is the most suitable period of the year for planting all varieties of citrus trees. Fair rainfall may be expected to keep the young trees going, and the spring conditions are conducive to early establishment.

Possibly the most important factor in planting is that the soil should be in good condition, well worked, and friable, and not by any means sticky when worked to plant the trees. The trees should be firmly planted, with the roots well spread. The subsoil immediately under the tree should not be disturbed to a greater depth than the surrounding subsoil, and though the soil should be firmed round the spread-out roots the top two inches of the surface soil should be left loose.

If the situation is in any way exposed to wind, young trees should be supported with a strong stake inclined towards the prevailing wind, and securely tied, but in such a way as not to injure the tree, and where possible a temporary shelter should be provided.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Artificial Incubation—*continued.*

It is well to heat the machine slowly, and when the regulator has been adjusted and the temperature of the egg-chamber kept at 102° F. for twenty-four hours it should be quite safe to put the eggs in. Allow the eggs to heat slowly, for heating too suddenly may cause broken yolks. A temperature of 103° F. with the bulb of the thermometer resting on the eggs should give satisfactory results. Special care should be taken to see that the temperature does not go too high, especially during the first week, for a temperatue of, say, 105° F. to 106° F. for even a few hours during that time often results in the death of the embryo, or it may be so weakened that it will die about the nineteenth or twentieth day.

Turning and Cooling.—Eggs are turned in order to give the developing embryo exercise and a fresh feeding-ground, and to prevent the yolk from settling down towards the shell. It is not necessary to turn each egg over; if the eggs are moved gently each day after the second day, and twice each day after the first week up till the nineteenth day, this should be sufficient. The time required for cooling depends a good deal on climatic conditions. Never let the eggs get cold—it is better to return them to the machine while luke-warm—*i.e.*, neither warm nor cold.

Moisture and Ventilation.—If the correct temperature has been maintained, and the eggs not chilled while cooling, and it is found that a number of strong germs die between the first test and hatching-time, one may look to the moisture or the ventilation position in most cases to find the cause. It is advisable to set a hen at the same time as the incubator is set, and to try to keep the air-cells of the eggs in the machine the same as those in the eggs under the hen. It will be found that the air-cells vary in size, but one need only strike an average. If a record is kept about the operation of the incubator showing when, and how much, moisture is applied, when and how the ventilators are worked, and also the temperature morning, noon, and night, it will act as a good guide for future work.

The Setting Hen.

When selecting a broody hen choose one that is quiet and can be handled. Avoid using a wild and nervous bird, and also avoid the hen with scaly

legs, as this trouble is likely to be transmitted to the chicks. All setting hens should be treated for insect pests by dusting with insect-powder, care being taken to see that the powder goes well down to the skin. Another good method of treating insect pests is to dip the end of a feather into nicotine sulphate and draw this under both wings, or among the breast-feathers. If no insect-powder or nicotine sulphate is at hand, a suitable mixture can be made by mixing equal parts of lime, dry earth, and sulphur. The best place to set a hen is in a coop away from other hens where she is not disturbed. A coop about 2 ft. 6 in. square with a run about 6 ft. long, and the same width as the coop serves the purpose. It is not wise to place coops close to stables or buildings, which are apt to attract rats. The nest should be made saucer-shaped and is better on the ground, while care should be taken to see that it is not too deep, or the eggs are apt to pile on top of one another. Have the nest flat on the bottom, and just sufficiently deep to cause the eggs to have a slight tendency to roll towards the centre when the hen turns them. The use of plenty of nesting-material is important to aid the hen to keep the eggs at a desired temperature, and soft, fine straw, hay, or pine-needles are suitable materials. The number of eggs to set under a hen will depend on the size of the hen and also on the size of the eggs. It is, however, always wise to set too few than too many. A hen of the average size of the Orpington, Rock, Rhode Island Red, or Wyandotte breed covers thirteen eggs comfortably. It is always well to remove the hen it is intended to set at night and place her on a few dummy eggs until she gives evidence of settling down.

The setting hen is best fed on grain alone, as mashes, meat, or green feed are apt to have a laxative effect, where the sitting hen is concerned, which may cause the eggs to become soiled, and in the event of this taking place the eggs should be cleaned and fresh nesting-material provided before they are put back in the nest. Grit and clean water should be within reach of the hen at all times, and a box containing some dry earth should be provided as a dusting-place when she comes off the nest. Do not disturb the hen at hatching-time, but when the hatch is completed it is well to remove the empty shells and those eggs that did not hatch. It is seldom advisable to help chickens out of the shells, for if they are not strong enough to get out on their own account they seldom develop into profitable stock.

Artificial Brooding.

In order to get the maximum return from his plant every poultry-keeper practically is compelled each year to renew from one-third to one-half of his flock.

This replacing of stock is probably the most expensive, and in many cases the most difficult, yearly task on large plants. More failures in the poultry business may be attributed to the inability of the poultryman to renew successfully his stock than to any other cause. It is advisable for any one going in for poultry-keeping as a means of providing a livelihood to start in a small way, or, better still, first to get some practical experience in the handling of brooder chickens on a successful poultryman's plant. Unless a poultry-keeper is able successfully to rear a sufficient number of pullets each year to renew his flock, he will find it impossible to make a success of poultry-farming.

Many troubles in chickens are caused by incorrect night conditions, such as over-crowding, over-heating, dampness, or want of ventilation. The successful poultryman is able generally to tell in a moment when he enters the brooder-house if the chickens are a little "off colour," and his practical experience enables him to find the cause and at once remove it.

Owing to the many different kinds of brooders in use, the various classes of chicks one may have to handle, and the almost daily climatic changes

it is impossible, or at least very unwise, to attempt to lay down a set of hard-and-fast rules by which all brooders could be worked successfully. The best brooders supply the chickens with plenty of room, warmth, and fresh air, but if there is a lack of any of these essentials the strain on the vitality of the chickens will be great and only the strongest will survive.

The success of a brooder depends largely upon its system of circulation and ventilation of air. Some fail in this respect, and the chickens are compelled to rebreathe the same impure, confined air. Such brooders are little short of death-traps, as breathing of bad air is very harmful for the chickens. After the chickens are a few days old it may be noticed that they do not come from under the hover briskly in the morning and appear stupid and dull for a few hours, but liven up as the day does on. The cause of this often is lack of fresh air at night, and in such cases it would be well to allow a little more ventilation just after the chickens have settled down for the night. There are many different styles of heated brooders on the market, and instructions as to their working are usually sent out by the makers, and it is well for beginners to follow these instructions carefully.

Some of the best results from the use of the canopy class of brooder have been obtained when the brooders were worked on a frame, in order to keep the chickens off the ground and allow air under their bed at night. Full particulars regarding the use of these frames may be seen in the Department's Bulletin No. 66, " Utility Poultry-keeping," copies of which may be had from the publisher, Department of Agriculture, Wellington ; price 1s., postage free.

Ground draughts should be guarded against, as they are at times the cause of chickens huddling. The chickens should be watched carefully as they camp for the night to see that they do not crowd to one side of the hover, and if they do this they should be gently spread out. This is one of the important details in connection with artificial brooding of chickens. Whatever class of brooder is used, the chickens should be somewhat confined during the first few days, or at least until they know what to do and where to go when they require warmth. The lack of this attention or training during the first few days is often the cause of the chickens getting chilled.

The heat of the brooder should be gradually reduced and more ventilation allowed as the chickens develop. Generally speaking, Leghorn chickens may be placed on the perches when between six and seven weeks old.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Early Season Examination of Colonies.

WITH the advent of warmer weather advantage should be taken of the fine days to make a preliminary examination of the hives. Provided that the colonies were queen-right in the autumn and had ample stores for the winter period, very little harm can come to them during the opening months of the spring. It is not sufficient, however, to conclude that all is well because the bees are flying freely and numbers of them are carrying pollen into the hives. These activities obtain even up to the point of starvation, and if taken as a guide to the condition of the hives may end in wholesale losses. To ensure, therefore, that all is well a critical examination should be made as early as possible. Although it is an advantage to postpone the spring examination until the bees are working fruit-bloom and early nectar plants, if it is thought the colonies need attention the work should not on any account be delayed. It must be remembered that the drain on the stores is enormous once brood-rearing has commenced. Everything should be in readiness before opening up the hives. The smoker should be going well, and the beginner would be well advised to protect himself with a good bee-veil properly adjusted.

Breeding.

Normally in September colonies should have a good quantity of sealed brood. If, however, there is absence of brood this points to a poor queen or to the likelihood that the hive is queenless. To attempt to carry such colonies through the spring months will lead to serious trouble, as they stand in danger of getting robbed. It is a far better plan to unite such colonies than run the risk of disturbing the whole apiary. A simple method of disposing of weak and queenless hives is to unite them with strong ones, and this may be carried out by placing a sheet of newspaper over a strong colony and putting the hive to be united on the top of the paper. In the course of a day or two the hive may be examined to see that the colonies have united. Should the paper be intact it must be torn in several places. It will be found in the course of a few days that the colonies are working peaceably. It is essential that breeding should be kept going steadily, so that the colonies will be strong in young bees to take advantage of the first flow of nectar. Food and warmth are important factors in inducing breeding, and these must have the constant attention of the beekeeper during the spring months.

Food-supply and Feeding.

As already indicated, the spring is the most critical period of the year for the beekeeper, and the success or otherwise of the season's work will depend almost entirely upon his efforts to guard against the losses attendant upon starvation. Large losses occur annually through neglect in this direction. When breeding is in full swing a considerable amount of food is used up daily for feeding the brood ; and, unless the weather conditions are favourable to enable the bees to work the early spring blossoms, it is essential that the food-supply be augmented. The amount of nectar gathered when the weather is favourable, in conjunction with their stores, tides the bees over long periods, but if bad weather follows, colonies often are reduced to a state of starvation before the owner is aware of their condition. If on examination a colony is found with insufficient stores to meet requirements, preparation should be made to feed it at once. It is not a safe policy to keep a colony at starvation-point, as this prevents the rearing of a succession of young bees to take the place of the rapidly dwindling number of workers at this period.

There are many feeders on the market which can be utilized for the purpose of supplying food. The division-board feeder is the best to use at this season, as it serves the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive. When making an examination of a hive to note its condition the feeder should be placed in the hive in readiness if it is anticipated that artificial feeding will have to be resorted to at a later period. All feeding should be carried on within the hives. Especially guard against feeding at the entrances, as that surely produces trouble. Place the feeder on the warm side of the hive, and in cases where the clusters are small the feeder can be inserted in position next to the cluster.

A point to remember in connection with feeding is that it creates an artificial flow and is stimulating, and, when started, it must be carried on until a natural flow from the fields sets in. If there is a suspicion of disease in the apiary, do not attempt to feed honey. In any case it is not wise to use honey taken from another hive, as it is impossible to be sure of its source. Feed only the best white sugar. It is a good plan to feed in the evening, as the discovery of the syrup excites the bees, and the colony has time to settle down before the morning, and there is less likelihood of the other colonies learning the cause of the excitement. A syrup composed of two parts of water to one of sugar, fed slightly warm, proves the best artificial feed for bees in the spring.

Detection of Foul-brood.

As suitable weather permits, every hive should be opened, one at a time, and a strict examination made for symptoms of foul-brood. If it is present, do not fail to mark colonies for treatment. Mild cases can be treated at a later period in the season, but if a colony is affected badly it is by far the safest plan to sulphur the bees and remove the combs to a place of safety. These combs can be converted into wax when a sufficient number warrant the undertaking. If isolated capped cells are discovered, these should be treated as suspicious. Healthy brood-cells are convex in form, bright in appearance, and in contrast differ greatly from diseased cells. These latter are slightly darker, concave in form, and are frequently perforated. Diseased cells of last season's production are usually so shrunken in appearance as to be easily detected, whether they are in an isolated position or surrounded by healthy brood

Precautions against Robbing.

Every precaution should be taken to prevent robbing getting a start in the apiary. Robbing may be caused by exposing combs too long when manipulating the hives, by careless feeding, and by the presence of weak and queenless colonies. These latter should not be tolerated, and the other causes can be obviated by care and attention. On no account should combs be exposed for long intervals, and if feeding has to be undertaken it should be deferred until late in the day. The excitement caused by feeding attracts other bees, and once they have tasted the material being fed they will continue to molest the hives for many days. As soon as robbing is detected it is far the best plan to postpone all operations in the apiary, and the entrances to the hives should be contracted at once. If a colony is in danger of being robbed it may be saved by piling wet grass in front of the entrance. Robbers are less likely to enter a hive so protected. The important fact about trouble from robbing is that prevention is the best plan in all cases. On no account spill syrup near the hives, do not leave combs lying about, and try to avoid weak and queenless colonies. One will then not be troubled with robbing.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

ON sandy lands by the seashore sea-kale is a perennial crop that is easily grown; such localities in Europe are its natural home. As the crop is harvested in the spring, it is of special value, as there is usually but little variety at that season. It may be grown from seed or root-cuttings. Seeds may be sown now in rows of 1 ft. or so apart and the plants thinned to a distance of 6 in.; they will then be ready for planting out permanently after twelve months' growth. Planting is done at a distance of 2 ft. between plants and 2½ ft. between the rows. Root-cuttings give a quicker return; they are made from pieces of root about the thickness of a pencil and about 4 in. or 5 in. long. It is convenient to cut the tops square across and the lower end with a slanting cut. These should be planted out now in rich ground well prepared in an open position, where the crop should produce well for five years or more. The top of the cutting should be 2 in. below the surface of the ground. A number of growths will appear from each cutting, but all should be removed except the strongest. Occasional applications of nitrate of soda bring the plants along strongly. The crop has a fairly wide range of adaptability, and need not be confined to the localities mentioned. When planting out seedlings now the crown of the root must be

cut off or the plant will produce a flower stem, which should never be allowed. A number of growths from the one plant develop; but they should all be removed except the strongest—as is done with root-cuttings.

The plants die down in the winter, when the beds should be cleaned up. Before growth commences in established beds, each plant should be covered with a box or pot to exclude the light; a tender blanched growth 8 in. or 10 in. long is the result. This always should be cut with a portion of the crown of the root, and the plant then allowed to grow naturally, the shoots being thinned, leaving only one or two of the strongest to complete growth. To do this satisfactorily a good dressing of manure should be applied and worked in during early summer.

A dish of moderate-sized leeks well grown has very much the flavour and attraction of good asparagus. The leek is a very hardy crop and subject to very few troubles of any kind. It is a reliable crop in fairly rich land in any climate. To produce plants for setting out towards the end of the year in land from which an early crop has been cleared a generous sowing should be made now.

The most delicious of the cabbage family are the Brussels sprouts, and very fine crops are now being grown here in the cooler districts. As they require rather a long season to complete their growth, they are sown thinly towards the end of September, and planted out about the month of November in a piece of ground which has been well manured and cultivated and from which an early crop of peas, &c., has been taken. To obtain the firm solid sprouts that are desirable good thrifty growth is necessary, and this is obtained by planting them out in ground that has become consolidated and has not been dug recently. An application of nitrate of soda or sulphate of ammonia may be made when the plants have become established, but it is to be remembered a too generous application of manures is detrimental.

The popularity of green peas demands a generous supply, to maintain which a sowing of mid-season variety should now be made. A rich, moist soil in which lime and phosphates have been included suits garden peas best.

Main-crop potatoes are usually planted during the months of September and October. While a rich, light loam is most suitable for the crop, it is often planted in rough land newly broken in, with a view to cleaning it and bringing it to a fine tilth. For this purpose the potato crop is very suitable. Rough dirty ground is quite unsuitable for fine seeds, and, while it may not grow a heavy crop of potatoes, it usually gives a potato crop equal to or better than any other crop that is obtainable from land in that condition. In addition, the hoeing, moulding, and digging aerate and sweeten the land as well as destroy the weeds. It is for these reasons that the potato is popular for assisting in breaking in new land.

In warm humid localities where early potatoes may be grown, but late crops are seriously subject to disease, kumaras are a very good alternative crop. They are grown from slips produced from tubers sprouted on a hot-bed. After making up the hotbed and allowing it a few days to settle down, spread 1 in. of clean sand, then sound kumara tubers close, but not touching. Then cover to a depth of 4 in. with clean sand or sandy loan. Water the bed thoroughly with a water-can, and keep it moist: great care is necessary in this, and it is safer to keep it rather on the dry side. In four or five weeks the tubers sprout, and when the shoots are 6 in. in length they should be removed carefully. At this stage they should have sufficient roots to sustain them. They should then be heeled closely, in a well-sheltered sunny position, and provision made so they may be covered readily should there be any danger of frost. Here they harden off and make root in readiness for planting out from the middle to the end of November. A sandy loam well sheltered is ideal for planting out this crop.

As the value of fresh salads is now generally appreciated, radishes and lettuce should be sown. And for those who appreciate a variety of vegetables salsify may be sown 1 in. deep in rows 15 in. apart. It has few enemies, and provides a generous crop of roots for winter use.

Where interest is taken in herbs, seeds of coriander, caraway, angelica, dill, aniseed, summer savory, and sweet marjoram may be sown ; the latter must be treated as a half-hardy annual, the remainder are quite hardy. Cuttings, with a heel of old wood, of sage, rosemary, lavender, and thyme may be taken and rooted in a moist sandy soil. Spearmint, peppermint, tarragon, and chives may be propagated by division.

Tomatoes and other half-hardy crops sown in boxes which are placed on a hotbed towards the end of August should be pricked out into other boxes as soon as they are big enough to handle. No artificial manure should be used with the soil, except that when the soil is poor a little fine bone-meal may be added. The boxes of seedlings should be returned to the hotbed and watered with tepid water through a fine rose. When the plants are established it is advisable to ventilate freely in fine weather and encourage steady growth in moderate temperatures.

Tomato Crops under Glass.

In the unheated glasshouse the tomato requires close attention at the present time owing to the changeable weather. Much has been said about the need of ventilation and of a dry atmosphere for this crop under glass, but the remarks apply chiefly to the early summer period when the house is crowded with growth. There is little danger from excessive humidity now, and a cold draught may seriously retard the crop. During the spring-time ventilators must be adjusted with every change in the weather so that steady growth is maintained ; and when late frosts threaten a few heaters of some kind should be at hand to meet the emergency. It is advisable to avoid forcing the growth when the lower bunches are setting, and to assist them, if necessary, by jarring the strings on which the plants are trained by rapping them smartly with a light cane or by drawing the cane quickly along the rows of twine ; this should be done about noon in fine weather. Shallow cultivation to break up the surface crust and destroy weeds is beneficial, and tepid water should be applied during the morning as required. Sturdy plants with plenty of blossom is the object in view ; rank soft growth, and poor setting are due often to high temperatures, excessive watering, and a loose rich soil.

Small-fruit Crops.

Light cultivation to destroy weeds and encourage growth should be given as necessary. Deep cultivation must be avoided carefully at this season or irreparable damage will be done to the fruit crop. Established plantations from which heavy crops are expected generally benefit from a dressing of fertilizers worked in about the time growth commences.

The planting of all hardy crops of this class should now be completed at the first opportunity during fine weather. Those crops which are inclined to be rather tender during the early stages of growth, such as passion-fruit, tree tomatoes, and Cape gooseberries, may be planted towards the end of October.

The Homestead Garden.

New lawns should be trimmed as soon as the grass is long enough for cutting ; use a mower that is in good order and set it high, generally as high as possible. Cut the lawn when the grass is dry and afterwards roll it with a light roller. When old lawns become thin and weedy this usually is due to a lack of fertilizing treatment. Applications of 3 parts sulphate of ammonia and 1 part of sulphate of iron are a popular dressing to suppress the weeds, but it is also necessary to manure the grasses and obtain a vigorous growth, so that weeds have little chance of again becoming established. On light land a rich dressing of complete manure of organic origin is most suitable. It should be in a dry friable condition so that it may be spread easily and may quickly work down to the roots of the grasses. On heavy land the dressing may be composed chiefly of artificial fertilizers well mixed with sharp sand. Early spring is the most suitable time for making these applications.

Rose-pruning should now be completed. Cut away the weak wood on young plants and shorten the remaining growth to 3 in. or 4 in., cutting just above buds that are pointing in an outward direction. This is considered destructive by those who are unaccustomed to the work, but it is not long before the treatment is justified by growth far exceeding that on bushes of the same age which have been pruned lightly. The bushes also become more shapely and develop other important characteristics.

Prick off half-hardy annuals out of seed-boxes, setting the young plants down almost to the seed-leaves. Firm the roots in the ground, but not the stem at the surface; the stem is very tender and liable to serious injury.

The decorative character of many pot-plants make them very desirable ornaments at times; they are also most economical if they are used appropriately. Palms, *Begonia rex* varieties, aspidistras, asparagus species, and ferns dislike much sun, and should be given shady situations. Warm, sunny positions are suited to geraniums, pelargoniums, and members of the cactus group. All pot-plants soon show signs of distress if fresh air is lacking, and cold draughts are equally injurious. The water used should be of about the temperature of the atmosphere, so it is often advisable to "take the chill off" in cold weather. Where potting or repotting is necessary, it is generally best done about the month of September. It is usually done satisfactorily, but improvement may sometimes be made by seeing that the roots of the plant to be operated on are moist, but not very wet. The plant should be repotted a day or two after watering. After setting the plant in a fresh pot, water it in, but withhold water afterwards until growth recommences and more water is obviously required. Results depend very much on the soil mixture used, most of the plants above-mentioned require rather a rich soil with plenty of humus (decaying organic matter, chiefly vegetable, such as leaf-mould) and sand to keep it open and prevent it setting hard. Equal parts of good loam, leaf-mould, and sand with the addition perhaps of a little fine bonedust suit most of those above mentioned. Where the soil is light, it is usually advisable to increase the loam and halve the quantity of sand used. Geraniums and pelargoniums should be potted firmly in a soil composed of 3 parts good loam, 1 part decayed manure, a little coarse sand, and a rather generous addition of bonedust.

— *W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

CREOSOTE AND FLAVOUR OF CREAM.

A. F. R., Swanson :—

It is proposed to build a shed for separating and keeping the cream on the off days. If the timber is coated with creosote would this have any harmful effect on the cream ?

The Dairy Division :—

It is probable that the smell of creosote would affect the flavour of the cream for quite a considerable time after using the creosote as specified. A separator-room is not a desirable place in which to keep cream, especially if attached to a milking-shed : a small shelter provided with ample ventilation at some distance from the shed is much better.

PAINT NOT DRYING.

E. M., Great Mercury Island :—

I mixed white zinc with *boiled* oil, and red lead with *boiled* oil, and neither paint dries, though washed with turpentine, and though the white was also painted over with a coat of quickly drying flat paint. (*a*) What are the specific differences between, and uses for, boiled, as opposed to raw, linseed oil ? (*b*) Is red oxide (of iron) the only metallic oxide forming a drying paint with boiled oil ? (*c*) By any means other than removal by blowlamp is it practicable to dry the paint mixed with boiled oil already applied ?

The Chief Chemist :—

The trouble probably lies in the oil not being really *boiled* linseed oil but something else such as *raw* oil or fish oil. Alternatively, trouble might be due to the surface painted not being clean. If it had already been painted with fish oil or bituminous paint or was oily, trouble might be experienced. (*a*) Boiled oil contains dryers, whereas raw oil does not, consequently boiled oil dries more quickly than raw oil. Boiled oil is darker in colour and more viscous than raw oil and hence has a lower penetrating-power. It is usual to use a mixture of boiled and raw oil (*b*) Many metallic oxides form drying paints with boiled oil. White zinc and red lead both do so (*c*) Probably removal of the paint is the only remedy if it fails to dry on standing

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ABNORMAL LIVER IN PULLET.

M. E. W., Greatford :—

The liver of a dead pullet was twice or three times the normal size and spotted with what looked like fat, more than anything else, though one large spot had turned to a cyst. She was laying and had an egg ready to pass. Otherwise she seemed in excellent condition, though a little over fat What is the cause of her death, and is it infectious ? The combs of several other birds in the same flock apparently started to colour and then lost the colour again. Is this likely to be due to the same cause ? If so, what preventive measures should be taken ?

The Live-stock Division :—

Without examining the stock it is not possible to say definitely what the nature of the trouble is, but probably it is a case of " enlargement of the liver," which is usually caused by improper feeding and want of exercise.

The feeding of too much rich food such as meat, meat-meal, or too much maize and wheat, with insufficient mash and green feed, may be the cause. If only one bird is affected, however, it is not advisable to make any change in your feeding, especially at this time of the year. If, however, other birds are showing signs of being affected in a similar way, it would be advisable to send an affected bird for examination to the Officer-in-Charge, Veterinary Laboratory, Wallaceville, Wellington, accompanied by a letter describing the condition of the flock. In the meantime give the birds more exercise by making them work for their grain in deep litter and increase the supply of green feed.

WEATHER RECORDS: JULY, 1935.

Dominion Meteorological Office.

NOTES FOR JULY.

THE weather in July showed some remarkable contrasts both in character and location. In most parts of the country, however, in the period up till about the 23rd, with the exception of a cold break from the 7th to the 10th, many days were mild for the season of the year, and there was evidence of this in the early blooming of spring plants and an appreciable growth in pasture. During the remainder of the month, on the other hand, conditions were cold owing to persistent and, at times, strong southerly winds prevailing. Accounts received indicate that in most localities grass was relatively plentiful, although in some it was necessary to resort to supplementary feeding, and on the whole stock kept in good condition. In the South Island the weather was favourable to all farming pursuits, so that winter sowing of wheat and oat crops appears to have been above the average.

Temperatures.—Temperatures did not vary greatly from the average, the difference being mainly a negative one, but at a few places about Cook Strait and on the east coast of the South Island it was slightly above.

Rainfall.—Rainfall over the whole of the South Island and in parts of the Taranaki Bight and central area of the North Island was below the average, while in the remainder of the North Island it was above. The largest differences above occurred in the North Auckland district, where, in places, it was more than double and the highest July fall ever experienced. The greatest deficiency was experienced in the western and southern areas of the South Island.

Storm Systems.—In contrast to the preceding month, July was remarkably free from severe widespread storms, although frequent depressions passing over or in close proximity to the Dominion caused disturbed conditions in different districts according to their exposure to the winds associated with these various low pressure systems.

Strong southwest winds prevailed on the 1st, a severe gale from that quarter blowing along the east coast of the South Island in the afternoon and evening. By the morning of the 2nd, however, the southerlies had decreased in force and a decided improvement in the weather set in.

On the 5th a cyclone, which had been moving slowly across the Tasman Sea, had reached northern New Zealand, and the weather rapidly clouded over. This disturbance brought almost general rains, except in Westland, between the 6th and 8th, heavy falls and some flooding occurring at places in the northern and eastern areas of the North Island. It passed away off East Cape during the night of the 7th, but a series of slight secondaries continued to move north of New Zealand, and the easterly winds associated with these brought intermittent rains to the northern and east coast districts of the North Island until the 10th, while the remainder of the Dominion was experiencing fine weather under the influence of an anticyclone.

From the 19th to the 23rd an intense anticyclone lay over New Zealand, but its central portion was situated in the south. At the same time a series of slight depressions passed to the north, and the far northern and eastern areas were again subject to scattered and, in places, heavy easterly rains. Otherwise the weather was fine in most parts of the country.

By the morning of the 24th the high-pressure system had passed away and a depression had moved on to northern New Zealand. The centre of this depression moved slowly across the North Island, passing in a southeast direction to the vicinity of the Chatham Islands on the 26th, where it became very intense, pressure at the Chatham Islands falling as low as 28·77 in. on the following day.

RAINFALL FOR JULY, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	7·35	16	2·05	5·48	40·34	33·64
Russell	12·19	18	2·70	5·27	65·82	32·60
Whangarei	14·06	22	3·41	7·10	57·18	38·70
Auckland	10·55	19	3·38	5·58	43·12	29·86
Hamilton	..	..	..	5·10	..	29·00
Rotorua	5·24	17	1·58	5·00	43·84	31·85
Kawhia	..	..	..	6·01	..	31·55
New Plymouth ..	6·88	18	1·44	6·38	48·79	34·02
Riversdale, Inglewood .	7·85	16	1·69	10·06	73·53	58·71
Whangamomona ..	4·92	7	1·61	7·27	53·96	42·97
Hawera	5·04	16	1·33	4·22	38·95	25·61
Tairua	10·54	20	2·27	6·31	51·03	39·87
Tauranga	5·65	19	1·15	4·94	41·81	31·82
Maraehako Station, Opotiki	3·16	14	0·96	4·45	49·06	32·24
Gisborne	6·28	21	1·45	5·05	31·25	29·96
Taupo	4·33	13	1·13	3·87	33·93	25·23
Napier	10·48	18	3·55	3·27	37·62	19·35
Hastings	6·35	16	1·55	3·66	27·85	20·29
Whakarara Station ..	12·83	23	4·85	..	45·68	..
Taihape	1·75	17	0·32	2·97	22·08	20·78
Masterton	6·04	18	1·25	4·18	24·30	22·95
Patea	3·83	19	1·39	4·23	35·38	25·63
Wanganui	1·69	13	0·39	3·34	25·70	21·04
Foxton	1·79	10	0·52	3·31	20·90	18·38
Wellington	4·32	14	1·18	4·85	21·47	25·74
South Island.						
Westport	4·01	12	1·60	8·30	53·96	54·80
Greymouth	3·25	7	1·44	7·93	59·90	57·49
Hokitika	3·22	8	1·32	8·96	71·48	64·05
Ross	3·40	5	1·50	9·18	69·53	71·95
Arthur's Pass ..	4·69	6	2·60	9·93	82·01	85·87
Okuru, South Westland	2·42	4	1·00	10·52	66·98	82·56
Collingwood	4·38	11	1·48	9·40	57·63	54·96
Nelson	2·31	6	1·40	3·48	27·13	21·80
Spring Creek, Blenheim	1·89	8	0·73	3·42	16·37	17·89
Seddon	1·27	12	0·33	2·40	10·78	14·72
Hanmer Springs ..	3·46	16	0·98	4·29	23·97	26·06
Highfield, Waiau ..	1·90	11	0·52	3·34	15·41	20·08
Gore Bay	2·21	9	0·99	2·80	13·78	18·67
Christchurch	1·06	13	0·28	2·54	12·72	15·17
Timaru	0·56	5	0·20	1·84	13·17	12·98
Lambrook Station, Fairlie	0·68	7	0·30	2·62	14·53	14·60
Benmore Station, Clearburn	0·77	3	0·72	1·74	14·05	14·54
Oamaru	0·86	9	0·26	1·72	12·58	12·70
Queenstown	0·28	3	0·22	2·03	20·20	17·38
Clyde	0·21	1	0·21	0·90	10·90	8·66
Dunedin	1·30	13	0·20	2·98	23·93	21·06
Wendon	0·61	6	0·33	1·74	23·13	17·22
Balclutha	0·56	7	0·20	1·78	21·08	14·49
Invercargill	1·78	16	0·40	3·27	32·96	26·58
Puysegur Point ..	5·18	14	1·14	6·15	52·91	48·41
Half-moon Bay ..	3·68	17	1·97	4·40	35·20	33·53

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SWAMP-PASTURES OF THE LOWER WAIKATO BASIN.

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IN winter, low-lying lands alongside the Waikato River are flooded with water, and show little or no promise of the surprising change to luxuriant pasture which comes with the summer and the fall in the waters of the Waikato. For six months these areas lie covered in water many feet deep in places, to be succeeded as the floods recede by swards of grass of extremely high production and palatable to stock—some of them very palatable. The change is all the more remarkable in that at present only very small areas, comparative to the large size of the flooded swamps of the Lower Waikato, show this unusual transition. Most of the area in the summer grows a profusion of useless rushes.

Truly the grass family is a remarkable one. It provides species capable of living in a great variety of conditions. Representatives can be seen growing on the seashore in sea mud, in dry soils, in high altitudes, and there are also species suited to swamp completely covered with water for half the year. Little attention has been paid so far to the use which can be made of land flooded with water for long periods. Such land is usually considered useless, and endeavours are made to drain it so that it will grow the grasses which thrive only in comparatively dry soils. Grass species which will grow without necessitating drainage—grasses forming carpets of green, fit to fatten cattle, produce butterfat, graze pigs and lambs—are not very well known, and their use has not been considered much.

A natural home for these grasses can be seen in the lower reaches of the Waikato River.

The Waikato rises in the volcanic plateau of the North Island, and its waters carry in suspension or roll along the river-bed great quantities of pumice sand. In the middle part of its course the river is mature and the bed is deep, and flooding does not occur.

At Taupiri, however, the river enters hilly country throughout which it pursues its course to the sea. Here and there throughout this hilly country the narrow valley widens out to form flood-plains on which the river deposits its burden of spoil from the central volcanic plateau. The river deposits most of this pumice material near its banks and so raises their level. Many of the numerous tributaries

which here join the river have not been able to fill their valleys as quickly as the dams across their outlets have been raised, and numbers of lakes and swamps have been formed. The principal lakes on the east side are Karaka (138 acres), Waikare (8,461 acres), Ohinewai (51 acres), Kimihia (672 acres), Hokanoa (170 acres), and, on the western side, Whangape (2,914 acres), Rotongaro (1,107 acres), and Wahi (1,242 acres). These, though they differ in size, all have the following essential points in common: they are very shallow, their surfaces are but little above the normal river-bed, and their outlets are across wide swampy flats of the present flood-plain. Throughout the swamps wander streams from the hills to connect directly with the river and streams connecting lake with river.

Owing to the upbuilding of the Waikato River banks, some of the lakes that at one time discharged into the Waikato now overflow into other lakes or rivers, the water seeping across wide swamps. Thus Lake Ohinewai drains to Lake Waikare, and Lake Rotongaro into the stream from Lake Whangape. Some lakes, such as Lake Waikare, partly discharge directly into the Waikato and partly into Whangamarino Swamp, which is drained by two streams into the Waikato.

Long sprawling spurs of rolling dry country reach out into the flood-plain, from which also low rounded hills rise like islands. The topography of this basin has obviously been produced by the smothering of a mature valley-system with river alluvium.

Along lake edges and the banks of the tributaries and waters of the Waikato River where they run through the flood-plain, pasture-plants have established here and there from isolated plants to areas containing hundreds of acres of land. Most of the flood-plain, consisting of thousands of acres, is covered in rushes, and there are also large areas of New Zealand flax.

The different pasture-plants existing on the flood-plain occupy differing levels, from areas covered deeply in water in winter to almost dry land. Their presence and prevalence is dependent on three factors:—

(1) The period of time the area is covered in water in winter and the depth of water in summer:

(2) Competition with other swamp-plants:

(3) The stocking of the area.

It is difficult to decide whether the line dividing the presence and absence of a pasture-plant indicates the period it will undergo submersion or whether it is the line marking its toleration of other swamp-plants which thrive under wetter or drier conditions. Also, the stocking of the area and the reaction of the different grass species to the degree of stocking have a bearing on their prevalence.

On the dry land alongside the swamps, dry-land pasture-plants, such as brown-top, white clover, suckling clover, and sweet vernal, and paspalum, are common. On top-dressed areas rye-grass is common. In the gullies descending to the flood-plain paspalum and *Lotus major* and Yorkshire fog are prevalent. In those gullies in which the water remains in the summer and flows but slowly, being stagnant in

FIG. 1. PASTURE OF POA AQUATICA AT KOPUKU.
(Photograph taken on 8th March, 1935, after growth of eighteen days.)

FIG. 2. MEADOW OF PASPALUM DISTICHUM AT WHANGAMARINO.

Fat lambs and cattle graze this meadow. *P. distichum* is also growing in the water at the edge of the creek.

(Photograph taken on 8th March, 1935.)

appearance, rushes are common, and competing with them strongly often is found the native punic grass (*Isachne Australis*), a rather unpleasant-looking grass with rusty green foliage which, however, provides a fair amount of not unpalatable fodder for stock in the summer. In these gullies the water does not reach a high level for more than a few hours, and is seldom deeper than 3 ft. In the summer, being fed by springs, they seldom run dry. It is here, whether the drying-out occurs or not, that the native punic grass thrives. Where the gully slopes to the flood-plain the native punic grass ceases to exist, for it apparently cannot live where submersion is fairly deep or it cannot tolerate the competition of other plants in such conditions.

Paspalum dilatatum and Yorkshire fog cease abruptly at the commencement of the flood-plain proper, and do not even extend as far into it as the native punic grass. *Paspalum dilatatum* will stand flooding for but short intervals.

Agrostis stolonifera ventures to live a few yards farther out than *Paspalum dilatatum*, but its presence almost as abruptly ceases. It apparently will tolerate limited flooding and is a common and valuable, though low-producing, pasture-plant for such conditions. Stock are fond of it. It is commonly known as creeping-bent and possesses over-ground runners which root at the nodes. Its leaves and flowering-stem are typical of the *Agrostis* species. Of the clovers, two only exist in flooded waters—*Lotus major* and, peculiarly enough, white clover. These extend side by side a fair distance into the flood-plain—much farther than *Agrostis stolonifera*. Their prevalence and production under the conditions is very limited. They both probably owe their presence as the result of establishment of seed left by the receding flood. That their extent is limited to a certain distance from the shore is probably due to the smothering competition of deep-water swamp-grasses which increase in vigour farther from the shore.

Below the level at which *Paspalum dilatatum* thrives among the rushes is often found reed canary grass, *Phalaris arundiceae*, a tall, strong-growing grass which is capable of living in fairly wet conditions. Its presence, however, is generally limited to the growing of isolated clumps among the rushes where the cattle pick. Meadow-foxtail is another, not so strongly-growing grass, which provides fodder for stock under similar conditions to those under which *Phalaris arundiceae* lives.

Floating-foxtail (*Alopecurus geniculatus*) is capable of living in very wet conditions in places covered with water for months on end, but it thrives best on areas less completely submerged. It is not a vigorous grower, and its growth period appears limited to the early summer months.

All the pasture-plants which have been mentioned are not capable of great progress on the flood-plain even at the shallower edges. They exist in competition with rushes, and even when aided by the influence of stock they are unable to suppress rushes and other weeds.

But there are grasses for which the swamp forms so eminently suitable a habitat that all other growth is suppressed. These pasture-swards can be formed in much wetter conditions than where meadow-foxtail and its associates will live. Two of them do not assert themselves except in the deeper swamps, and many of these contain luxuriant

pastures free from useless plants, while the margins are mainly rushes with *Lotus major*, white clover, *Agrostis stolonifera*, and a few of the deeper swamp-grasses. These latter are not native grasses, and they have barely commenced an attack on the plants in their habitat in this region. Two species will live in swamps 2 ft. deep in summer with water which must be 6 ft. deep in winter. It is on land that dries out sufficiently in the summer to support stock that they are of economic value, and almost all of the flood-plain of the Lower Waikato Basin dries out sufficiently for this purpose. Growing as they do in the summer in a soil rich in food and moisture, their production is very great indeed. In winter, in one of the localities where they are established, a bare expanse of water is all there is to see—in the summer a

FIG. 3. PURE ASSOCIATION OF GLYCERIA FLUITANS, EXCEPT FOR TWO PLANTS OF WILLOW-WEED

(Photograph taken on 2nd January, 1935)

field of grass supporting numerous stock. These areas are of proved value for summer grazing of stock when the ordinary pastures are dried up.

These deep-water swamp-grasses form pure swards. They eliminate competition by their vigorous growth. At the present moment they are limited to the margins of streams and places near running water, but they gradually are extending their range. It is possible that finally they will provide large areas for grazing of stock. These grasses do not merely provide "pickings" for stock, but can make fields of pasture which compare very favourably with our dry-land pastures in their production, palatability, and their lack of weeds.

One of these grasses is *Poa aquatica*. It is the highest producer. It is like in appearance to maize, the seed-head resembling somewhat the male flower of the maize and standing as high. The stem is not

nearly as thick, however. The leaves are similar in appearance, but are much smaller, being yet very coarse compared with the common dry-land pasture-grasses. The foliage of the plant can be mistaken for raupo at a casual glance at a few yards' distance. The production of *Poa aquatica* is about 15 tons of green fodder per acre where it grows vigorously. It is capable of living in very deep water, and can be seen growing in places covered with several feet of water even in the driest of summers. But it grows best where the land is dry enough in the summer to support cattle. It also grows on dry land, but it prefers a position where water covers the ground throughout the winter. Frosts do not affect it to a large extent, and its climatic range is fairly great. That it is palatable can be seen from the way that stock graze fields of this grass to within a few inches of the ground. It has been considered not as palatable as the other swamp-grasses, but this may possibly be due to the fact that frequently the ground is too soft to support stock where it grows until midsummer, by which time it is coarse and has grown 7 ft. or 8 ft. in length. Even at this stage cattle eat it and keep in good condition on it. But its milking qualities are then not good. *Poa aquatica* sets seed freely, upon which it relies for reproduction. It appears, however, to be a perennial. It is capable, without the aid of stock, of suppressing vigorous rush-growth. With the advent of stocking it appears to be replaced by closer-growing swamp-grasses of spreading habit. The latter are seldom seen except in swamps where stock have ready access, whereas *Poa aquatica*, while prevalent in stocked areas, is more frequently observed making inroads against rushes and flax in unstocked areas.

Paspalum distichum or Mercer-grass is the most valuable of the swamp-grasses. It supplies by far most of the fodder for stock grazing in the swamps of the Lower Waikato Basin. It supplies fields of up to 100 acres consisting purely of this grass. It is essentially dependent on stock for its march of progress against the rushes of the swamp. This grass does not set seed freely, and spreads by over-ground runners which root at the nodes. There is no doubt about its palatability, as it is greedily eaten by stock, and it forms dense pleasing swards of dark green. It is at present confined to within about two miles of the margins of streams, from which it is possible that it will gradually spread over the large back-water swamps, some of which contain thousands of acres of useless land. It is at present making the greatest progress of any of the deep-water swamp-grasses, and, aided by stock, is gradually invading the rush-covered areas. Its production is probably higher than that of *Paspalum dilatatum* in its own habitat. When the flooded waters recede in the late spring, a bare expanse of oozing mud greets the eye. A little later here and there sickly green shoots of *Paspalum distichum* appear, and in a few weeks the ground is a solid sward of this grass, being fed usually by fattening cattle and dairy cows. This growth continues till the cold winter weather commences and the return of the water covers the area. Mercer-grass will live alongside *Poa aquatica* in the deeper waters, and its range in the other direction is apparently as good. It is difficult to distinguish it from *Paspalum vaginatum*, which lives in the driest of conditions and occurs as a vigorous weed on clay tennis-courts, and is frequently observed on roadsides.

Glyceria fluitans, or floating sweet grass, is also a sward-forming grass in areas covered more lightly with water in the winter than is

FIG. 4. PASPALUM DISTICHUM AT KOPUKU
(Photograph taken on 18th February, 1935.)

FIG. 5. CLOSER VIEW OF VEGETATION SHOWN IN FIG. 4

the case where *Paspalum distichum* thrives. It is often associated with *Paspalum distichum*. In the deeper places *Paspalum distichum* forms a pure sward. Farther to the shore associations of *Glyceria fluitans* and *Paspalum distichum* are found, and still nearer the swamp edge pure swards of *Glyceria fluitans* are to be seen. After this a thin belt of creeping-bent and floating sweet grass is to be found merging into rushes and dry land. Floating sweet grass can be found making many acres productive alongside creeks. It differs from *Poa aquatica* and *Paspalum distichum* in that it is not dormant in the winter, and it lives with trailing stems moving with the flow of the water and its leaves floating canoe-like on top of the water. In the summer, when it throws a considerable amount of fodder, it sets seed, having a seed-head similar to rye-grass in appearance. In the winter stock will wade up to their bellies to pick mouthfuls of this palatable grass. However, relative to the summer production the winter production is not large. In the summer it appears as equally palatable as Mercer-grass. *Glyceria fluitans* is a common weed in drains.

The soils of the Lower Waikato swamps are for the great part formed by pumice silts deposited by the Waikato, but large areas are also composed of unconsolidated peat. The type of soil does not appear to affect greatly the grassing of these wet areas. The fertility of the soils of dry land depends largely on their capacity to give a continuous supply of moisture to the roots of pasture-plants. The great objection to drained peat swamps is that they dry out so much in the summer that pasture-plants will not grow. In an undrained state where the water-table is so high that they are always moist their suitability for the growth of many moisture-loving plants is quite satisfactory. Mercer-grass and creeping-bent thrive well on these soils in such conditions. Some areas of peat are so deep that when drained they are almost useless for pastoral purposes. There is no doubt that many acres of drained peat swamps would have been better utilized in a wet state by the colonization of them with moisture-loving grasses.

Of the alluvial areas, the alternative to non-expenditure of money on drainage and the establishment of summer producing swamp-grasses is the riddance effectively of the surplus water. If drainage is not completely successful so that rye-grass of high production can be established, the result will not be satisfactory. Half-drained land supports only rushes with a weak competition by grass and clover, and is of much poorer total potential production than land in its natural wet state. It has a virtue, however, which the undrained swamp does not possess, in that the area is able to carry stock every month in the year and not merely in the summer.

On the flooded areas of the Lower Waikato Basin sections of land can be freed of flooding by excluding the waters of the Waikato by stop-banks and the provision of flood-gates. But this does not go far enough. Having prevented the intrusion of water from the Waikato, the area will still remain too wet to grow rye-grass and vigorous white clover because of natural drainage into the area from the surrounding high country and the slow seepage of water from the surrounding flood-plain. Drains leading to the flood-gates must be dug, and the water in drains must be kept at a low level. This is brought about by the use of pumps which are driven cheaply by electrical power, and which raise the water from the drains and empty the water into the external flooded area over the flood-gate. By pumping the water in this manner in the wetter periods of the year it is possible to keep the water in the drains

at a very low level, while outside the flooded waters are above the level of the land. These pumps raise the water up a tube varying in diameter according to its working-capacity. The water is drawn up the tube by disk-like flanges working like a spiral, and the water issues over the stop-bank or through a flood-gate against the force of water outside.

The writer noticed these pumps first in 1929 on the Aka Aka Swamp, and at that time the only pump being operated was one patented by a local settler. The Aka Aka Swamp is situated in Franklin County near the mouth of the Waikato, and originally was one of the flood-plains used by the river. The area consists mainly of pumice silts with some areas of peat near the hills, which are derived from basic volcanic eruptions. This was stop-banked and huge canal-like drains led to flood-gates. These alone were not found effective enough by the settlers, and they commenced individually to block the outlets from farm drains to the main drains which run along the road frontages to their farms. The pumps, called Irwin's Swamp disk-pumps, and flood-gates were installed at the blocked junctions of the drains leading from the farms and the main canal-drains. These operated satisfactorily, and now numbers of farms on the Aka Aka area have the surplus winter water removed in this manner and farm drains are kept dry in winter, while outside the main drains are almost full of water. Electric-power lines run along the roads, and so connection with the power-supply is not expensive.

Pumps were used with tubes of 12 in., 15 in., and 18 in. diameters. An 18 in. pump required a 3 to 5 h.p. electric motor, a 15 in. pump a 3 h.p. motor, and the 12 in. pump a 1½ h.p. motor. The pumps were capable of a lift of 3 ft. 9 in. If a higher lift was required, two pumps could be used auxiliary to each other. The pumps were found capable of draining from 50 to 200 acres, the area drainable depending on the degree of wetness of the area and size of pump used. On one farm of 60 acres an 18 in. pump was found necessary for the wettest of seasons. A 12 in. pump had been installed and found to be unsatisfactory. On another of 140 acres a 15 in. pump dealt easily with the water. On the former farm power cost 3d. a unit and averaged £12 yearly, varying from £4 to £24 according to the winter rainfall. On the latter farm power cost 4d. a unit, and the average cost was £7.

The total costs in the above instances are set out below :—

60-acre Farm.	£	s.	d.
12 in. pump	10	0	0
Motor, wires, and one pole	14	0	0
Jarrah timbering for support of pump	5	0	0
Tin shed over motor and pump	10	0	0
Concrete work	3	0	0
Flood-gate	4	0	0
Total cost of materials and setting-in	£46	0	0

140-acre Farm.	£	s.	d.
15 in. pump	17	0	0
Motor	11	10	0
9 chains of poles and wire at £2 3s. per chain	19	7	0
Cement and sand	2	7	6
Total setting-in costs	£50	4	6

The pumps are capable of the following deliveries: 18 in. pump, 100,000 gallons per hour; 15 in. pump, 75,000 gallons; and 12 in. pump, 50,000 gallons. The pastures on the Aka Aka Swamp where well drained comprise good rye-grass, Yorkshire fog, paspalum, and white clover of high production. Where drainage is inefficient, rushes and catsear form a large proportion of the sward, and the production is low. It seems probable that the expulsion of water from the Aka Aka Swamp could have been brought about more economically and more efficiently by larger pumps operating at the entrance of the main canal-drains to the Waikato River.

Lately, attempts are being made by individuals to rid the water from small areas of the flood-plain in other parts of the Waikato Basin, using stop-banks, flood-gates, and pumps. On one area of 55 acres a pump capable of delivering 65,000 gallons per hour, costing £78 for pump and motor, has been used. This pump works automatically when the water rises to a certain level in the drain, and has removed in the season an equivalent of 45 in. of rainfall for £16, the cost of power being 1½d. per unit.

If the owner of a flooded swamp which dries out sufficiently in the summer to support stock wishes to make the area productive, he has two ways of doing so. He can adopt the well-tried method of drainage to dry the land so that it will support grasses suitable to dry conditions, or he can establish grasses suited to the land in its natural state. By effective drainage he will obtain production from the area the whole year round. Colonization with swamp-grasses will result in production only during the summer months. The establishment of rye-grass - white clover swards can be brought about only by much labour in the erection of stop-banks, digging of drains, preparation of a seed-bed, and expenditure in the purchase of a pumping outfit, and the continual demands maintenance makes in the cleaning of drains and the pumping-out of the water must not be overlooked.

The establishment of swamp-grasses is not a costly or a laborious undertaking. As yet, very little of it has been done, and the great swamp-pastures of to-day owe very little to man for their presence. Beyond a little fencing, the expenditure of money entailed by the establishment of a wet swamp-pasture is practically nil. The establishment of *Poa aquatica* probably is accomplished most easily by collecting and sowing seed from these grasses as soon as floods have subsided sufficiently so that progress can be made on the swamps. Mercer-grass is best established by planting cuttings of the stolons or overground creeping stems as soon as these can be obtained, so that the grass is well established before winter comes. Planting will be most successful in portions of the swamps on which the soil is wet in the summer.

After all, the drainage or non-drainage of swamps is decided by the need of the farmer for winter or summer fodder. If not much dry land is available for winter feeding of stock, then drainage to make more dry land is probably the correct step to take. If the farm comprises for the main part dry land from which plenty of surplus hay and silage can be made, then the colonization of the swamp with grasses natural to these conditions may well appeal. To many, the non-drainage of these great areas is considered a great waste of potential production of farm-products. Yet these areas are the safety-valves of the great Waikato River. Too often has the close confinement of great rivers created problems through the silting and continued rise in the river-bed, the inevitable consequential flooding, and the loss of stock and property and risk of life.

THE PRESERVATION OF SILAGE.

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DURING recent years the work of Woodman, Amos and Williams, and others has demonstrated the values of the different types of silage. It has been shown that in England oat and tare silage can be classified into five groups, as follows :—

(*a*) Sweet dark-brown : Usually stack silage where air has access.

(*b*) Acid light-brown : Usually in silos made from moderately mature herbage allowed to wilt.

(*c*) Green fruity : Made in silo from less-mature herbage than above, without wilting.

(*d*) Sour : Made from immature and succulent herbage, without wilting, and saturated with rain.

(*e*) Musty : Black silage where presence of air has allowed growth of fungi.

Chemical analyses and feeding trials have shown that of the above types acid light-brown and green fruity silage are preferable in that they possess approximately the same digestibility and nutritive values as the materials from which they are made, and they do not suffer the changes and losses which occur in the dark-brown silage produced under high temperature or in sour silage.

CAUSES OF ENSILING.

After storage chemical and biological changes are responsible for the conversion of vegetation to silage, and a knowledge of the changes is necessary to understand how the different types of silage arise. Three factors are suggested as the cause of these changes : (1) The respiration of the plant cells ; (2) the activity of plant enzymes ; and (3) the activity of bacteria.

RESPIRATION.

The plant cells live for some time after cutting, and the normal respiration utilizes a small part of the plant carbohydrate, which in combination with the oxygen of the surrounding air is converted to carbon-dioxide and water. This process is accompanied by a rise in temperature noticeable within the first hours of storing a crop. If sufficient air is present, as in a crop of low moisture content or where settling is slow, this initial temperature may rise to 120° F. or higher, at which point the cells are killed.

ENZYMES.

During this early period, and after the death of the cells, constituent enzymes are capable of acting on the complex substances of the plants, particularly the proteins, and causing a breakdown to simpler organic compounds such as amino-acids. This reduction of complex constituents closely resembles the process of digestion in animals, but it is doubtful if the process is advantageous in preserving the silage or increasing the nutritive value of the material.

BACTERIAL ACTION.

The activity of bacteria is the most important and by some authorities is considered the only agent by which silage is preserved. Preservation, in which deleterious bacteria are prevented from developing, is dependent on the production of a high lactic-acid content. Lactic-acid bacteria utilize the available plant carbohydrates, but where there is a deficiency of these compounds other bacteria develop and cause an excessive breakdown of plant nutrients, particularly of the proteins. Similarly where the herbage contains a large proportion of legumes, where excessive seepage leaches out the soluble carbohydrates or where very low temperatures exist, lactic-acid bacteria are retarded in their activity and other organisms predominate. In this way are formed the compounds considered objectionable, particularly acetic, propionic, and butyric acids, the last being characteristic of sour silage. The value of acetic acid is not fully understood. In the absence of adequate lactic acid, acetic acid may help to preserve the silage, but its presence indicates a breakdown of food material. Experiments on the food-value of acetic acid have given conflicting results, and, since excellent silage can be made without the formation of noticeable amounts of this acid, in the following experiments its presence has been considered as undesirable.

In recent years the principle that high acid content is necessary for silage preservation has been applied in the A.I.V. system, in which hydrochloric acid is added at the time of ensiling the crop. In this case extra precautions are required to exclude air in order to prevent the growth of moulds, and the addition of calcium carbonate is necessary when feeding the silage.

As indicated previously, green fruity silage is made from succulent herbage which after cutting is stored with a minimum of wilting. In New Zealand grass-pasture silage predominates, and an attempt is made to produce the above green fruity type. On an average farm, from three to six days are required for harvesting, which usually involves cutting in the morning and storing in the afternoon, or, where more labour is available, cutting and storing as continuous or alternating operations. Succulent herbage is preferred, and there is a tendency to form sour silage. During the last three years experiments have been conducted (1) to determine a practicable method of treating silage to prevent the formation of the sour type, and (2) to determine if good silage can be made from material normally considered over-mature for this purpose. The experiments have aimed at a rapid production of lactic acid, and for this purpose cultures of bacteria and sugars have been added to the material at the time of storing.

EXPERIMENTAL METHODS.

For the first trials 44-gallon petrol-drums were utilized, the herbage being weighted by a 7 in. layer of soil. Pipes for thermometers passed through the soil into the silage. These drums held approximately 220 lb. each, and six were used for each experiment, the solutions being sprinkled on the material during filling and tramping. In the second and third years of the experiments three hillside pits partly enclosed

by timber and each of ½ ton capacity were used to check the results obtained in the drums. The pits were similarly filled, treated, and tramped, and were weighted with a covering of from 8 in. to 10 in. of soil. Drainage was provided in both drums and pits. A minimum period of six weeks was allowed for the silage to mature, though the majority of the experiments were left from three to four months before examination. Chemical analyses of the silage could not be undertaken, and the results are based on the condition of the material and the presence of objectionable acids as indicated by odours peculiar to these acids.

The herbage used for the trials varied considerably, this being due partly to seasonal variations in growth and partly to the proportions of rye-grass, clover, or cocksfoot included in the mixtures; but for each experiment the material was thoroughly mixed so that each bin or pit received similar material. Usually the herbage was cut in the morning, turned if very succulent, and stored in the early afternoon.

The experiments included the testing of the following: Cultures of *Bacillus bulgaricus*, *Streptococcus thermophilus*, *S. lactis*, a cheese starter, whey, hydrochloric acid, and molasses. The first four were "set" in milk a few hours before use, and the whey was freshly run from cheese-vats. In all cases the control was treated with the same weight of water as the liquid used for each treatment.* In experiments 1 and 2, 3 lb. of liquid was used in each bin, but in the subsequent trials the amount was increased to 2 per cent. As shown in the table, molasses was used in every trial, as ½ per cent. addition in the bins and as 1 per cent in the pits (see numbers 9, 11, 13, and 15).

RESULTS.

In a few trials, 2, 3, 10, and 12, good silage resulted in all the bins, and the differences were only slight. In most trials the controls produced sour silage, due to the presence of large amounts of acetic and butyric acids, and in only one trial, 10, did the control give better silage than a treatment. Usually the controls were of a lighter colour, with a glazed leaf surface and a partially collapsed condition of the leaf tissues.

Bacillus bulgaricus.—Cultures of this organism are capable of high lactic-acid production, and, as the results indicate, improved the quality of the silage. There was a marked reduction in the formation of acetic acid and butyric acid, and very little change in the colour or texture of the material. An addition of ½ per cent molasses resulted in further improvement with the production of a pleasant aroma. Cultures of *B. bulgaricus* are difficult to prepare in sufficient quantities for the use of farmers, but the trials have demonstrated the value of an active lactic-acid organism in silage preservation

Streptococcus thermophilus, S. lactis, and Cheese Starters.—These cultures do not produce as high a lactic-acid content as *B. bulgaricus*, and the results did not justify many trials. They did not show the consistent

* A typical experiment was arranged as follows: (1) Control: Water, 4 lb.; (2) Water, 3 lb.; molasses, 1 lb. (3) Water, 3 lb.; *B. bulgaricus*, 1 lb. (4) Water, 2 lb.; *B. bulgaricus*, 1 lb.; molasses, 1 lb. (5) Water, 2 lb.; whey, 2 lb (6) Water, 1 lb.; whey, 2 lb.; molasses, 1 lb.

improvement given by *B. bulgaricus*. When they were combined with molasses a slight improvement occurred, but this was probably due to the effect of the molasses alone.

Whey.—As shown in the table, whey was used in eight trials, in two of which it was compared with cultures of *B. bulgaricus*. Applications of ½ per cent. whey gave satisfactory results, and larger quantities up to 4 per cent. gave improvement in proportion to the amount added. The whey always reduced the formation of acetic and butyric acids, and, with the larger amounts, gave a bright, clean silage. The addition of molasses further improved the quality of the silage, though in combination with 4 per cent. whey the only added effect over whey alone was the formation of a pleasant aroma.

Molasses.—Molasses was used in every trial, and consistently gave better results than the controls. Molasses-treated silage usually had a pleasant odour, retained a freshly cut appearance, and when combined with *B. bulgaricus*, hydrochloric acid, or fresh whey reduced the objectionable acids and odours to a minimum. The additions were restricted to a maximum of ½ per cent. in the bins and 1 per cent. in the pits, since the cost of this sugar to farmers prohibits the use of larger quantities.

Acid.—In experiment 4, hydrochloric acid applied as 0·8 per cent. solution was compared with *B. bulgaricus* and molasses. The results demonstrated that, provided air is excluded, commercial acid gives an excellent method of preserving silage, but in the quantity tested very little better than *B. bulgaricus* plus molasses. The amount of acid added is below the theoretical quantity required to give the necessary acidity in the silage, but the cost of acid in New Zealand prohibits its use, since an application of 0·8 per cent. would mean an additional cost of approximately 4s. per ton of silage.

Material.—As indicated previously, the herbage used in the trials varied considerably, and the resulting silage as shown by the controls was similarly variable. The best silage prepared from untreated material was obtained from wilted succulent rye-grass mixed with white clover. The poorest silage was made from non-wilted succulent rye-grass or mixtures of coarse rye-grass and cocksfoot normally considered too mature for ensilage. These classes of material gave good silage when treated with whey, molasses, or *B. bulgaricus* plus molasses.

Temperatures.—A record of the temperatures obtained in the trials did not show any relation between temperature and treatment or conditions of the silage. The highest temperatures were recorded between the fourth and sixth days, but these rarely exceeded 90°. F., the maximum temperature being 102° F.

CONCLUSIONS.

The quality of silage can be improved materially by the addition of lactic-acid organisms, hydrochloric acid, whey, and molasses. Of these treatments whey and molasses, alone or combined, are the best for farm practice in that they are the cheapest sources of sugars available and at the same time give excellent results when applied to many types of herbage.

Table summarizing Trials relative to the Curing of Silage.

Material.	Control	Control plus Molasses.	Starter.	Starter plus Molasses	B. bulgaricus.	B. bulgaricus plus Molasses.	S. lactis.	S. lactis plus Molasses.	S. thermophilus.	S. thermophilus plus Molasses.	Acid	Acid plus Molasses.	Remarks.
1. Old rye-grass plus young rye-grass	Poorest	Fair	Poor	Poor	Good	Best	..	..	..	..	..	..	Control very sour.
2. Succulent rye-grass (wilted) ..	Fair ..	Fair	..	..	Good	Best	..	..	Fair	Fair	..	..	Control slightly sour.
3. Succulent rye-grass (wilted) ..	Fair ..	Fair	.	.	Good	Best	Fair	Fair	..	..	..	..	Control slightly sour.
4. Succulent rye-grass (wilted) ..	Poorest	Good	..	.	Fair	Good	..	..	..	..	Good	Best	Acid trials gave clean bright silage except around top sides.
5. Coarse, dry rye-grass	Poorest	Good	Fair	Good	Good	Best	..	..	..	..	..	..	Control sour.
6. Coarse, dry rye-grass	Poor	Good	Fair	Poor	Best	Fair	..	..	.	..	..	..	Bin 4 not treated top third.
	Control.	Control plus Molasses.	B. bulgaricus.	B. bulgaricus plus Molasses	Whey ½%	Whey ½% plus Molasses.	Whey 1%.	Whey 1% plus Molasses	Whey 2%.	Whey 2% plus Molasses.	Whey 4%	Whey 4% plus Molasses.	
7. Succulent rye-grass (wilted) ..	Poorest	Good	Fair	Good	Good	Best	..	..	.	..	..	..	Control an objectionable silage.
8. Coarse rye-grass plus white clover	Poorest	Fair	Fair	Good	..	..	Best	Good	..	..	..	..	Control mainly acetic.
9. ½ rye-grass plus ½ cocksfoot ..	Fair .	Good	..	..	.	..	..	..	..	..	..	..	Pits: Control mouldy; molasses decidedly better.
10. Succulent rye-grass plus 20% white clover	Good	Good	..	..	Fair	Fair	Good	Best	..	..	..	..	Only slight differences—ideal material.
11. ½ succulent rye-grass plus cocksfoot	Fair ..	..	..	..	..		..	..	..	..	Good	Best	Cocksfoot slightly coarse; molasses improved aroma only over whey.
12. 2 succulent rye-grass plus 1 cocksfoot	Poorest	Good	..	..	Fair	Fair	1½% Good	Best	..	..	..	..	Differences not marked.
13. Succulent rye-grass plus white clover	Poorest	..	..	..	..	..	..	..	Best	Good	..	..	Control, objectionable acids.
14. Coarse rye-grass plus 15% coarse cocksfoot	Poorest	Fair	..	..	..	..	Fair.	Good	Good	Best	..	..	Control, objectionable acids; Bin 6, pleasant aroma.
15. 3 rye-grass plus 2 succulent white clover	Poor	..	..	..	..	..	..	..	Good	Best	..	..	Control, bad aroma and appearance; molasses best aroma.

THE NORTH TARANAKI PASTURE COMPETITION.

REVIEW FOR SEASON 1934-35.

A. G. ELLIOTT, Instructor in Agriculture, New Plymouth.

THE judging of this competition organized by the joint committee representing the Taranaki Agricultural Society and the Farmers' Union has now been completed, and the following table showing entries from the various districts since the inauguration of the class in 1930 is an indication of the interest shown by farmers throughout the territory :—

TABLE OF ENTRIES.

District.	Season.				
	1934–35.	1933–34.	1932–33.	1931–32.	1930–31.
Urenui	23	24	22	17	10
Inglewood	11	6	2	12	17
Huirangi	..	8	7	12	11
Kaimata	4	4	3	11	6
Lepperton	14	8	9	7	4
Tikorangi	4	7	7	10	2
Okato	9	9	5	20	..
Toko	7	10	8	5	..
Tarurutangi	5	7	8	8	..
Wharehuia	17	15	16	..	..
Omata	..	3	4	..	..
Hurworth	..	..	2	..	..
Oakura	..	11	..	..	..
Hillsborough	..	3	..	..	..
Ngaere	10	..	..	..	..
Tariki	3	..	..	..	..
Totals	107	115	93	102	50

Each pasture entered in the competition was judged in the spring and again in the autumn, this procedure being generally regarded as the most sound and equitable method of awarding points on the basis of all-the-year-round production of feed and utilization and management of fields.

Judging was carried out by observation, and points were alloted on the same scale as last season—*i.e.*, good grasses, 30; clovers, 25; freedom from inferior grasses, 5; freedom from weeds, 10; denseness of sward, 15; evenness of sward, 15: total, 100. A full explanation and definition of each of these subdivisions was presented in the report last year, and further experience has not provided any reason to make any alterations for the future, as the present method is proving as satisfactory as is possible under the very varied conditions which obtained throughout the territory.

In order to have the North Taranaki championship awards made under conditions as closely comparable as possible, it was decided that this season the first five pastures should be rejudged on the same day, but as there was so little difference between some entries the number was increased to eight.

While in many cases competitors entered only the best pasture on the farm, a number submitted entries of fields concerning which they were in doubt as to whether it would prove economical to renovate them by top-dressing and good management instead of ploughing and subsequently resowing them. While it is an honour to a district to have the winner of the open championship in its community, every encouragement should be given to those farming pastures of doubtful value as exemplified above to enter them and thus be enabled to secure from the result of the judging a definite opinion as to the success of the method of regeneration employed In other words, this competition should be viewed in its widest sense as offering an excellent means of raising the standard of pastures and pasture management and utilization throughout each district, and this in North Taranaki generally. Great credit is due to those competitors who enter good pastures each season, as they have in most cases raised them to the present standard by their own effort and initiative, but where one must naturally look. for the marked improvement in the future is from pastures lower down the championship list, usually on country in not such an advanced state of fertility, and where good methods must in time bring greatly increased carrying-capacity through the establishment and maintenance of better swards.

From information supplied by competitors the following useful data were obtained :—

Acreage of Paddocks.—The average size of all fields entered was 6·3 acres, the actual sizes being—3 acres, 9 fields ; 4 acres, 18 ; 5 acres, 23 ; 6 acres, 17 ; 7 acres, 12 ; 8 acres, 11 ; 9 acres, 3 ; 10–15 acres, 11 ; 15–20 acres, 2 ; over 20 acres, 1 field.

These figures show clearly that the value of subdivision and controlled grazing is fully realized in the district, and it is obvious that in regard to this very important factor in increasing production farmers are making a real effort to follow practices which have proved profitable in other dairying districts.

Age of Pastures.—The average age of the pastures entered was 12·5 years shown individually as follows : 3 to 7 years old, 20 ; 7 to 10 years old, 33 ; 10 to 15 years old, 22 ; 15 to 20 years old, 15 ; over 20 years old, 17.

Pastures to be eligible for entry must be three years old, and the figures available emphasize the fact that in general most of the oldest pastures are among the best : the average age of the first ten this year was 12·6 years.

Time of Sowing.—Details were available in ninety-five instances, and of these seventy-nine were sown in the autumn and sixteen in the spring, while of the latter the majority were established in the inland districts.

Quantity of Seed per Acre.—This varied from 30 lb. to 65 lb. per acre, as shown by the following table :—

30–40 lb. per acre	20
40–44 lb. per acre	19
45–49 lb. per acre	20
50–54 lb. per acre	11
55–59 lb. per acre	3
60–65 lb. per acre	6

A study of these figures shows that about half the entries were sown at the rate of from 40 lb. to 50 lb. per acre, which can be regarded as being an economical and satisfactory seeding. As shown above, however, the average age of the first ten pastures was over twelve years, and details of seedings were not available in some instances. The opinion is expressed freely and is founded on experience in many districts that the only method of securing the necessary quick cover to control weed-growth and give the young pasture the best possible chance for forming a close sward is the sowing down with heavier seedings of from 50 lb. to 60 lb. per acre. It is possible, however, that two or possibly three very important factors have been overlooked by those who advocate heavy seedings and these are—(1) The thorough preparation of the land prior to sowing to cope with weed-growth ; (2) the higher standards of germination and purity of seeds now on the market ; and (3) the great importance of consolidation of the seed-bed and correct cover of the seed after sowing. Of these, the first two are obviously matters which easily can be agreed upon, as in the first instance the comparatively small cost of an additional working will be compensated for amply in the securing of a clean "strike," which is of the utmost importance in the later life of the pasture. In considering the second factor it must be admitted that where, say, rye-grass of known and proved type and over 95 per cent. purity and germination is used 1 bushel should be ample in a 45 lb. mixture. Consequently, with improvement in seeds, it is not necessary to sow additional seeds to offset useless material for a possible loss, and the heavy seedings should be unnecessary under good conditions. The third factor raises, however, what is possibly a very controversial matter, but one that can be judged readily by the farmer himself provided he keeps in mind the fundamental fact that seeds of grasses and clovers have much smaller reserves than do those of, say, beans and peas. The first requisite is of course the soil moisture, and this is available only on a firm seed-bed where capillary action is possible, and after germination the fine roots immediately seek plant-food in solution from the soil. This, of course, introduces the question of sowing fertilizers with the seed, a matter which will be discussed later. It seems that more than the present amount of consolidation common throughout the district should be employed, and the seeds should be covered to such a depth as to enable them to be in contact with soil-moisture and yet be as free as possible from depredations of birds. The open, friable soils predominating in the territory require more consolidation than was probably thought necessary in earlier times, and one reason why the older pastures still show up so well in comparison with later-sown ones may be due to the fact that rather poor "strikes" were secured and the present swards are the result of many years of

top-dressing and good management and utilization. It is a practice in some districts to drive sheep over the newly sown areas, and this is obviously an appreciation of the importance of consolidation, which in this instance is carried out by the mob, which gives hoof-cultivation as well as a firm seed-bed with the necessary cover for the seed.

Manure with the Seed.—Manure was sown in sixty of the seventy-nine entries. There was great variation, as shown by the following details: No manure, 19 entries; superphosphate, 32; Superphosphate plus lime, 8; Superphosphate plus bonedust, 5; Superphosphate plus basic slag, 1; bonedust, 3; proprietary, 8; blood and bone, 2; North African phosphate, 1.

In this connection it is evident that the importance of having readily available plant-food close to the young seedlings is realized fully, and the use of superphosphate on thirty-two sowings emphasizes this fact. It is possible that the addition of slag, lime, or either blood and bone or bonedust would have improved the position in giving an extended fertilizer effect, and the use of such mixtures is a practice in certain districts.

Subsequent Top-dressing.—The following table indicates the recent manurial treatment subsequent to sowing:—

Top-dressing.	1932.	1933.	1934.
Basic slag	30	17	9
Superphosphate	36	31	23
Lime plus superphosphate	19	21	22
Slag plus superphosphate	4	3	4
Slag plus potash	..	1	1
Phosful	5	2	2
Phosful plus superphosphate	1	..	..
Superphosphate plus blood and bone	1	2	3
Blood and bone	1	1	..
Ammoniated superphosphate	..	..	2
Slag plus ammoniated superphosphate	2	..	..
Superphosphate plus potash	2	4	8
Rock phosphates	..	2	5
Proprietary	6	9	19
No manure	..	7	9

The greatly decreased use of slag undoubtedly is due to the difference in price between it and other fertilizers in the present time of restricted finances for top-dressing, and the figures above are a remarkable example of how farmers are trying various straight manures and mixtures in an effort to replace economically one with which they were familiar through years of its application. It is obvious that superphosphate is forming the bulk of all mixtures to supply the necessary phosphate basis, but nitrogen in the form of the organic manures and also as sulphate of ammonia is being tried. Potash is also being tried in a number of cases, and in addition to the mixtures shown above it is a constituent

in most of those made up by merchants and included in the table under the heading "Proprietary." Lime plus superphosphate in the table includes proprietary manures which are combinations of these two top-dressings, and the addition of lime to superphosphate is becoming an increasingly popular farm practice in top-dressing. The use of nitrogen and potash is still in the investigational stage, although there are a number of successful farmers in the various districts who annually include potash in their top-dressing mixtures.

Quantity of Top-dressing applied.—This varied from 2 cwt. to 5 cwt. per acre, as shown below:—

Quantity per Acre.	1932.	1933.	1934.
2 cwt. ..	3	3	4
3 cwt. ..	84	82	76
4 cwt. ..	17	13	12
5 cwt. ..	3	2	6

Quantities up to 3 cwt. per acre were applied in one dressing, while those over 3 cwt. were in most cases top-dressed half in the autumn and half in the spring. The practice of making two applications is gaining favour, and it seems as if it will become the regular method as financial conditions improve.

Types of Harrows used.—The importance of harrowing in good pasture-management is obviously recognized, and, while there is not much definite knowledge available on the subject, the fact that only seven competitors entered areas which had not been harrowed is significant. It is advisable to harrow with some form of implement to spread droppings, but there is not a great deal of information available on the subject of root-pruning and soil-aeration in the well-established sward. The makes of harrows used by the entrants were—Tripods, 34; Burke, 17; chain, 11; Whakatane, 10; Taylor, 7; chain and tine, 7; Reid and Gray, 4; Evona, 3; Wilson, 2; Wright-Stephenson, 2; Duncan, 1; Alfa, 1; Massey, 1.

More than half of the areas entered were harrowed with a tripod or modification of this type of flexible implement, and quite good work is performed by such types. It would appear that the use of the heavier and more severe types is largely governed by the condition of the sward and whether it is proposed to follow the operation by the inclusion of pasture-seeds in the top-dressing mixture and subsequent rolling. When seed is distributed the harrowing associated with this is scarcely harrowing in the generally accepted use of the word: it is actually a method of surface cultivation by which a more or less deteriorated pasture is improved by use of the harrowing and the seed-sowing. The question of the drastic harrowing of a close sward of highly productive pasture-plants is extremely controversial, and is the subject of investigation. The following details show the number of times the various pastures were harrowed: 1 stroke, 24 entries; 2 strokes, 34; 3 strokes, 13; 4 strokes, 15; 5 strokes, 7; 6 strokes, 6; 7 strokes, nil; over 7 strokes, 1; no harrowing, 7.

Carrying-capacity.—As an example of how the smaller farms under more intensive management compare with larger areas on which less care and attention can be given to each acre, the following figures, which indicate the number of acres required per cow on farms of various sizes, and which can be regarded as representative of the whole territory, are interesting: Up to 50 acres, 1·81 acres per cow; 51 to 75 acres, 1·97; 76 to 100 acres 2·03; 101 to 150 acres, 2·11; over 151 acres, 2·13.

The following shows the carrying-capacity on farms of competitors, and illustrates the fact that the field entered in the competition does not necessarily receive special treatment but is typical of the pastures farmed: Competitors securing over 180 points, 1·56 acres per cow; 175 to 179½, 1·93; 170 to 174½, 2·07; 165 to 169½, 2·39.

The champion pasture for the season was the No. 1 entry of Mr. W. F. Goodin, Okato, which was awarded 184 points. It was 7¾ acres in area and nine years old, sown in the autumn with 60 lb. of seed per acre. It was top-dressed in 1932 and 1933 with basic slag at 3 cwt. per acre and last season had the same amount of guano. The pasture was harrowed six times with the tripod and chain, and was topped in the 1932 and 1933 seasons. Rye-grass and white clover were dominant in the sward, with timothy and a small proportion of paspalum, and the denseness and evenness of the sward were outstanding. Mr. Goodin entered two other fields, which were also high up in the district list, showing that the standard of pasture on his farm is high. The champion field secured second place last season, and grazes 120 cows when being fed off.

Mr. J. N. Blyde, Lepperton, secured second place with a field 3½ acres in area, which was awarded 182 points, and which is over twenty years old. It has been top-dressed twice each year, as follows (quantities per acre): 1932, 2½ cwt. superphosphate in the spring and 3 cwt. calciphos in the winter; 1933, 2½ cwt. superphosphate and 1½ cwt. 30 per cent. potash in spring and 5 cwt. lime, 2½ cwt. superphosphate, and 2 cwt. 30 per cent. potash in winter; while last season it received 2 cwt. superphosphate and 1½ cwt. 30 per cent. potash in spring followed by 4 cwt. lime, 2½ cwt. superphosphate, and 1¼ cwt. 30 per cent. potash in winter. This pasture was awarded highest honours in the autumn judging in the whole territory, and is dominant rye-grass, white clover, with timothy and cocksfoot, the whole sward being dense and even and remarkably free from weeds. It was harrowed three times with the Burke implement, and was topped once during the season.

Mr. J. H. Paulger, Tikorangi, was awarded third place with a twelve-year-old pasture of 4· acres sown in the autumn with 40 lb. of seed and 3 cwt. of superphosphate per acre. This entry secured 181 points, and the dense, even sward consisted of rye-grass, cocksfoot, and white clover, with a small percentage of paspalum and crested dogstail. In 1932 it received superphosphate 3 cwt. with 1 cwt. 30 per cent. potash; 1933, 2 cwt. superphosphate and 1 cwt. 30 per cent. potash; and last season as in 1933. It was harrowed twelve times during the season with a Wright-Stephenson harrow, and was topped once. This entry was second highest in the autumn judging.

Mr. G. Downes, Wharehuia, secured fourth position with his entry in the open class, a 5-acre field nine years old, sown in the autumn with 50 lb. of seed and 3 cwt. proprietary grass manure per acre. It was top-dressed in 1932 with basic slag 3 cwt.; 1933, calciphos, 3 cwt.; but no fertilizer was applied last season. The pasture is dominantly rye-grass, cocksfoot, and white clover, with a small percentage of rib-grass and dandelion, and was harrowed twice with tripod and chains and cut for hay.

SWEDE AND TURNIP VARIETIES.

THEIR DESCRIPTION AND DISTRIBUTION IN NEW ZEALAND.

J. W. HADFIELD and R. A. CALDER, Agronomy Section, Plant Research Station, Palmerston North.

THE area devoted to the swede and turnip crop in New Zealand amounts to over 400,000 acres and is therefore greater than that devoted to any other arable crop. In this review an attempt is made to define the relative importance and ecological adaptability of the main varieties as indicated by the area devoted to each. This has been possible only through the co-operation of Fields Superintendents and Agricultural Instructors attached to the Fields Division, who have answered a questionnaire designed to supply the information required. Acknowledgments and thanks are here accorded to all those who have co-operated.

Secondly, an attempt is made to describe the more important varieties and to group them, and opinions are expressed in regard to synonymity. Synonymous varieties should be so alike in both appearance and performance that they can be regarded with no hesitation as the one agricultural variety. This is not easy in a self-pollinated crop, and in one that is cross-pollinated, such as swedes or turnips, the difficulty becomes greater owing to variation. Moreover, it is to be expected that differences will be apparent among the distinct stocks of any one variety that have been raised by different firms or breeders or seed-growers. These differences are sometimes slight or of no apparent agronomic importance. Nevertheless it becomes difficult to assign the particular degree of variation that shall be sufficient to warrant recognition of varieties in such work as this.

Physiological differences are still more difficult to define and yet are far more important, involving as they do such important matters as disease-resistance, yield, chemical composition, and ecological considerations.

Synonymity has therefore proved to be a very difficult matter, and, despite the fact that statements herein are based on three years' observations at this Station, and for a lesser period in Southland, they are by no means conclusive. For convenience of description varieties are grouped according to morphological characters, but varieties in any

one group, although so closely approximating one another in appearance as to defy differentiation, may be widely dissimilar in other respects, as, for example, Bruce and Purple Top Yellow Aberdeen, Wallace and Green Top Yellow Aberdeen. On the other hand, varieties of widely different appearance may prove to be very similar in other respects, as in the case of Hernings and Wilhelmsburger Otofte.

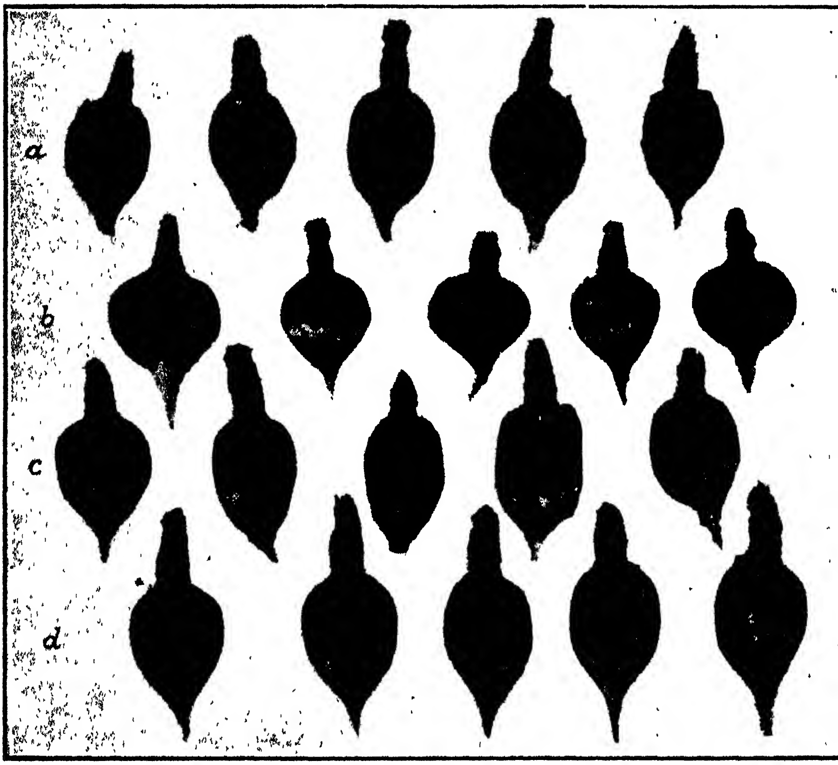

FIG. 1.

a (top), Garton's Superlative ; *b* Sutton's Superlative ; *c* Webb's Masterpiece ; *d* Garton's Superlative sold under the name Grandmaster.

Note the distinct type of Sutton's Superlative.

In the varietal descriptions much assistance was rendered by Mr. R. B. Tennent, Director of the Fields Division, who was then Fields Superintendent for Southland and Otago, and by Mr. J. O. Wallace, of the Department of Agriculture, Dunedin, who corroborated by plot trial those observations made at this Station.

In collecting material for the illustrations an attempt has been made to select typical roots which show, to some extent at least, the range of variation within each variety. They cannot be regarded as exhibition roots. The photographs are by Mr. H. Drake.

For the purposes under review the Dominion has been subdivided as follows :—

District defined.	Short Title used in Table.
Southland west and south of a line joining Mossburn and Edendale	West Southland.
Eastern Southland and part of Otago extending to Kelso	East Southland.
Clutha, Bruce, Taieri, Waikouaiti, Peninsula, and part of Tuapeka Counties	Mid and South Otago.
Central Otago, west of Middlemarch	Central Otago.
North Otago: Palmerston South to the Waitaki River	North Otago.
Canterbury, south of Rangitata River	South Canterbury.
Canterbury, between the Rangitata and Rakaia Rivers	Mid-Canterbury.
Canterbury, north of Rakaia River	North Canterbury.
Marlborough Province	Marlborough.
Nelson Province	Nelson.
Horowhenua, Oroua, Manawatu, Kiwitea, Pohangina, and Woodville Counties	Manawatu.
Woodville to East Coast and south	Wairarapa.
South Taranaki, east of Patea River	South Taranaki.
North Taranaki, west of Stratford	North Taranaki.
Rangitikei, Waimarino, Waitotara, and Wanganui Counties	Wanganui.
Hawke's Bay and Poverty Bay Provinces	Hawke's Bay and Poverty Bay.
Bay of Plenty district	Bay of Plenty.
Putaruru, Rotorua, Takoroa	Central Plateau.
Waikato, Waipa, Raglan, Otorohanga, Waitomo, and north Matamata Counties	Waikato and King-country.
Manukau Harbour, south to Taupiri Range	South Auckland.
North Auckland Peninsula, north of Manukau Harbour	North Auckland.

DISTRIBUTION OF SWEDES, YELLOW FLESHED AND WHITE FLESHED TURNIPS.

Table 1 has been prepared from replies received to the questionnaire submitted to Instructors in Agriculture. In this table, as in others to follow, the figures are estimates prepared by those best able to judge the proportionate area devoted to each variety from a knowledge of the district and inquiries from seed-merchants as to the quantity of seed sold.

It will be seen from the table that of the total area of crop 45·5 per cent. is devoted to swedes, 17·2 per cent. to yellow-fleshed turnips, and 37·3 per cent. to white-fleshed turnips. It shows also their relative importance in the twenty-one districts into which the Dominion has been divided for the convenience of this review.

TABLE 1.—DISTRIBUTION OF SWEDE, YELLOW-FLESHED TURNIP, AND WHITE-FLESHED TURNIP AREAS IN NEW ZEALAND.

—	Total Area of Swedes and Turnips.		Acreage in each District devoted to			Percentage in each District devoted to		
	Acres.	As Percentage of Dominion Average.	Swedes.	Yellow-fleshed Turnips.	White-fleshed Turnips.	Swedes.	Yellow-fleshed Turnips.	White-fleshed Turnips.
Total area covered by return	427,750	*	194,850	73,550	159,350	45·5	17·2	37·3
Western Southland	50,000	11·7	31,000	16,500	2,500	62	33	5
Eastern Southland	52,000	12·1	26,000	18,300	7,700	50	35	15
Mid and South Otago	42,000	9·8	16,800	12,600	12,600	40	30	30
Central Otago	6,500	1·5	400	4,650	1,450	6	72	22
North Otago	11,000	2·6	2,200	900	7,900	20	8	72
South Canterbury	49,000	11·4	24,500	4,900	19,600	50	10	40
Mid-Canterbury	38,800	9·1	3,500	3,500	31,800	9	9	82
North Canterbury	39,500	9·2	3,950	3,950	31,600	10	10	80
Marlborough	2,900	0·7	300	300	2,300	10	10	80
Nelson	4,000	0·9	600	400	3,000	15	10	75
Manawatu	10,100	2·4	4,400	1,000	4,700	44	10	46
Wairarapa	9,000	2·1	3,300	200	5,500	37	2	61
South Taranaki	6,850	1·6	3,750	1,050	2,050	55	15	30
North Taranaki	11,600	2·8	7,200	1,150	3,250	62	10	28
Wanganui	34,000	8·0	19,700	700	13,600	58	2	40
Hawke's Bay and Poverty Bay	4,000	0·9	3,000	300	700	75	7	18
Bay of Plenty	3,700	0·9	2,250	200	1,250	60	6	34
Central Plateau	2,700	0·6	2,400	100	200	90	3	7
Waikato and King-country .. .	38,300	9·0	35,200	1,550	1,550	92	4	4
South Auckland	4,000	0·9	1,300	500	2,200	33	13	54
North Auckland	7,800	1·8	3,100	800	3,900	40	10	50

* The Government Statistician reports for the season 1933–34, 414,911 acres turnips and 63,741 acres turnips and rape mixed

Swede Varieties.

Of the many swede varieties grown under trial only those at present of economical importance in New Zealand are mentioned. They are grouped according to morphological characteristics as follows:—

				Varieties.	Group.
Swedes	Yellow flesh	Red skin	Intermediate red in colour. Shape, oval. Shoulders rounded to square	Superlative (Garton's) Masterpiece (Webb's) Success	Garton's Superlative.
			Bright red with tinge of purple. Shape, globe. Shoulders very square	Majestic Grandmaster Tipperary	Majestic.
			Colour, drab-red or bronze-purple Shape, globe. Shoulders rounded	Magnum Bonum John Bull Paramount Superlative (Sutton's)	Sutton's Superlative.
		Purple skin	Colour, deep purple. Shape tankard. Shoulders rather square	Crimson King Elephant Monarch	Crimson King.
			Colour, purple. Shape, globe. Shoulders rounded	Champion John Bull Masterpiece (Carter's)	Champion.
		Bronze skin	Shape, oval. Shoulders rounded	Hurst's Bronze Top Incomparable Great Crop	Bronze Top.
			Shape, globe. Shoulders rounded	Hernings Caledonian Up-to-Date Invicta Halewood	
		Green skin	Mostly globe-shaped, with shoulders rounded	Sutton's Green Top Benefactor Hurst's Conqueror Wilhelmsburger Otofte	Green Top
	White flesh	Purple skin	Very deep purple, tankard-shaped Deep-rooted	Vilmorin Sensation	White flesh. Purple Top.

In the above classification of shape, and in those of turnips to follow, the system adopted has been—

Tankard: Length twice the width.

Oval: Length one-and-a-half times the width.

Globe: Length and breadth equal.

Flat: Length less than breadth.

GARTON'S SUPERLATIVE GROUP.

Varieties: Garton's Superlative (Fig. 1*a*), Webb's Masterpiece (Fig. 1*c*), Success.

The leaf mid-rib and stalk are pale purple and green. Skin colour is an intermediate red with a decided gloss. In shape the root is oval, with shoulders that vary from rounded to square. Flesh is yellow. Samples sent in for trial contained an occasional bronze top, but otherwise were very pure and uniform. All lines branded "Masterpiece" (Fig. 1*c*), (except Carter's Masterpiece) were indistinguishable from Garton's Superlative, and may be regarded as synonyms, and of eight lines of Grandmaster three had to be classed as Superlative (Fig. 1*d*). Superlative sold under the description "Sutton's" (Fig. 1*b*) is distinct in shape and colour from that sold under the description "Garton's," and the former has therefore been included elsewhere—namely, in the Sutton's Superlative group.

Superlative has been for many years, and still is, the most popular and widely grown variety. To what extent Garton's or Sutton's Superlative respectively has been responsible for this record cannot be ascertained, but since in many trials conducted in the past Garton's has been specified, and as this type and other varieties very similar to it (Masterpiece and Grandmaster) dominate the position at the present time, it may be surmised that the Garton's type is the more popular, representing as it does over 22 per cent. of the total area in swedes.

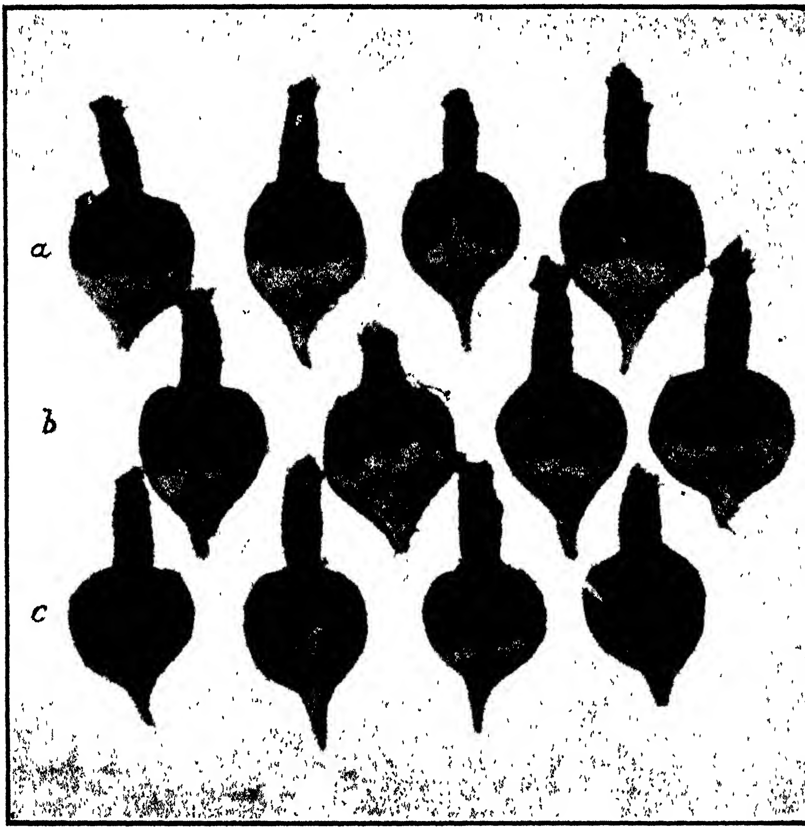

FIG. 2.

a Grandmaster ; *b* Majestic ; *c* Tipperary.

In departmental trials conducted about 1911 Garton's Superlative is recorded as being decidedly resistant to club-root, but this resistance has not been maintained in recent years, and at the present time the variety can by no means be regarded as having any special merit in this respect. On the other hand, in nearly all trials it is reported to have been more severely infected with dry-rot than other varieties. It is not possible to say whether this high infection has been due to varietal susceptibility or to the imported seed being more highly infected than other varieties, or to both causes. It is true, however, that, despite

these weaknesses, Garton's Superlative has taken a leading place in yield trials and in agricultural shows throughout the Dominion. Little is known of the variety "Success" except that in these trials it could not be distinguished from Garton's Superlative. Masterpiece and Garton's Superlative together represent approximately 36 per cent. of the New Zealand swede crop.

MAJESTIC GROUP.

Varieties : Majestic (Fig. 2*b*), Grandmaster (Fig. 2*a*), Tipperary (Fig. 2*c*).

Foliage a medium green with a slight bluish tinge, mid-rib and stalks green, tinged with reddish-purple. Skin colour a bright red with a purplish tinge. Globe-shaped, with very square shoulders. Flesh yellow.

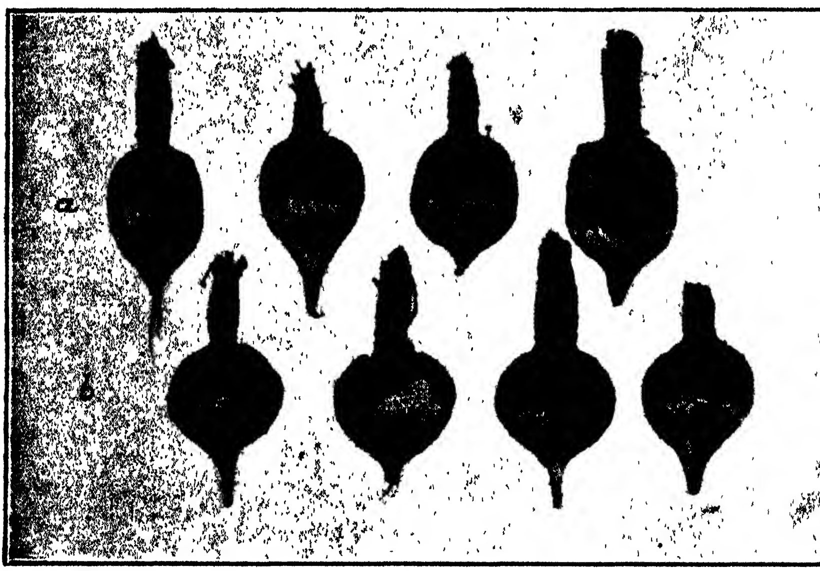

FIG. 3.

a and *b* : Two types of Magnum Bonum were included in the samples collected for trial.

In all trials, both here and in Southland, it has not been possible to differentiate between Majestic (Fig. 2*b*) and Tipperary (Fig. 2*c*). They are not grown as extensively as would seem to be warranted from the results of these trials, in which they were outstandingly promising, and the few yield trials in which they have been included support this view.

The group has been termed "Majestic" because this variety typifies the group far better than Grandmaster. It is, in fact, questionable whether Grandmaster (Fig. 2*a*) should not be included in the Superlative group (Fig. 1) rather than in the Majestic group since certain of its characteristics place it between the two.

Grandmaster is increasing in popularity, more particularly in the southern portion of the South Island, where it is competing with Garton's

Superlative for supremacy. It is deservedly popular and an excellent variety. The group represents about 12 per cent. of the total area in swedes, Grandmaster alone being responsible for over half of this.

SUTTON'S SUPERLATIVE GROUP.

Varieties : Magnum Bonum (Fig. 3), Sutton's Superlative (Fig. 1*b*), John Bull, Paramount, Challenge Pioneer.

Foliage medium green with a faint bluish tinge, stalks and mid-rib tinged with reddish-purple. Colour is an intermediate red to bronze-purple or drab red. Shape, globe. Flesh yellow.

Sutton's Superlative is the most important variety in this group. Although in the estimate of areas devoted to different varieties an attempt is made to differentiate between Sutton's and Garton's Superlative much reliance cannot be placed upon these figures. Merchants and growers are for the most part unaware that any difference exists. Magnum Bonum is rapidly being replaced by newer productions, while in the sample submitted for trial John Bull was of two types, those not included here falling into the Champion group. The variety is, however, relatively unimportant. Paramount and Challenge Pioneer are tentatively included in this group. Little is known of them, and their distribution is insufficient to warrant their inclusion in the tables.

(To be continued.)

THREE FUNGI CAUSING "BROWN-PATCH" OF LAWNS IN NEW ZEALAND.

R M. BRIEN, Mycological Laboratory, Plant Research Station, Palmerston North.

FOR a number of years a disease known as "brown-patch" has been prevalent in bowling and golf greens and lawns in various parts of New Zealand. The object of this article is to record that the following fungi have been isolated from diseased turfs forwarded from the various centres.

(1) *Sclerotinia trifoliorum* Erikss.—This fungus is the cause of stem and root rot of clovers and lucerne, and is prevalent in Europe(1), England, and the United States of America, both on these and other members of the Leguminosæ. *S. trifoliorum* was first isolated from playing-greens in New Zealand in 1932. Since then infected turfs have been obtained from putting-greens at Rotorua and Pukekohe (these consisting mainly of *Hydrocotyle* sp.), from bowling-greens at Wellington and Auckland, and from a croquet-lawn at Masterton. This last-mentioned green had been sown down mainly with suckling-clover (*Trifolium dubium*).

The disease appears as small circular patches from 6 in. to 8 in. in diameter, in which the turf first turns yellow, then brown, and finally dies out. These patches generally occur irregularly over the whole surface of the green.

(2) *Corticium vagum* Berk et Curt.; Synonym = *Rhizoctonia solani*, Kuhn.—A disease of lawns and playing greens due to a strain of

Corticium vagum, and known as "large brown-patch," has been prevalent in the United States of America for a number of years. It was first recorded in 1919 by Piper and Coe(2). In New Zealand during the past three years a strain of this fungus has been associated with similar symptoms. Cultures have been obtained from specimens of infected turfs from bowling and golf greens at Hamilton, Auckland, Gisborne, and Dunedin.

The disease appears firstly as small, circular brown areas (2 in. to 3 in. in diameter), which gradually increase in size, often attaining a

PATCHES CAUSED BY THE FUNGUS CORTICIUM FUCIFORME ON THE GREENS RESEARCH AREA, PALMERSTON NORTH.

[*Photo by E. A. Madden.*

diameter of approximately 2 ft. These patches are scattered throughout the green, and sometimes coalesce, forming diseased areas up to 6 ft. in diameter. The grass on these areas turns brown and eventually dies, leaving bare places over the green.

(3) *Corticium fuciforme* (Berk.) Wakef.; Synonym = *Hypochnus fuciforme* (Berk.) McAlp.—The disease known as "red-thread," caused by the fungus *Corticium fuciforme*, has been present for some years both in Australia and New Zealand. In New Zealand the fungus was first collected in 1920 on *Lolium multiflorum* growing in the Hawke's Bay District. Since then *C. fuciforme* has been isolated from diseased patches on lawns, bowling and golf greens in the Hawke's Bay, Wairarapa, Manawatu, and Nelson districts.

The "red-thread" disease (see illustration) first appears as small, irregularly-shaped, light-brown patches measuring approximately 2 in. to 3 in. across. A characteristic feature of this disease is the red thread-like growth of the fructifications of the fungus, which project from the

foliage of the sward. These fructifications are usually present on grasses attacked by *C. fuciforme*. The fungus spreads rapidly through the green, leaving patches varying in size from 6 in. to 10 in. across, in which the turf dies out.

The three fungi recorded above overwinter in the soil, and, when warm, humid atmosphere conditions prevail, attack the lawn-grasses, producing symptoms as described above.

REMEDIAL MEASURES.

Where greens have become infected with any one of the above fungi, further spread of the disease may be checked by the application of mercuric chloride solution, 3 oz. to 50 gallons of water, this being sufficient to treat 2,000 square feet of lawn. This treatment has been successfully applied to bowling-greens at Hamilton and also to putting-greens and plots on the Greens Research Area, Palmerston North. Treatments on the Greens Research Area were carried out in conjunction with Mr. E. A. Madden, of the Department of Agriculture.

LITERATURE CITED.

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(2) PIPER, C. V., and COE, H. S.: Rhizoctonia in lawns and pastures. *Phytopathology*, Vol. 9, pp. 89–92; 1919.

CYANOGLUCOSIDES IN WHITE CLOVER.

B. W. DOAK, Plant Research Station, Palmerston North.

MUCH has been heard recently concerning the effect of white clover on animal-health and on " feed flavour " in dairy-products. The question about the relationship of the troubles experienced to the presence of cyanogenetic glucosides in the white-clover plant naturally arises.

Following on the qualitative observations by overseas workers that a certain strain of white clover—namely, Kentish wild white—contained a substance capable of liberating prussic acid (hydrocyanic acid), the writer investigated the quantitative aspect and found that the various white-clover strains contained varying amounts of potential hydrocyanic acid. This hydrocyanic acid is not present in the plant in the free state, but is in a combined state as a cyanogenetic glucoside from which the free acid is liberated by enzyme action. As the result of work with the Agrostological Section of the Plant Research Station a definite correlation was found to exist between the strain or type of white clover and the potential hydrocyanic-acid content. The results obtained during the first two years' investigations were published in the *New*

Zealand Journal of Science and Technology, Vol. XIV, pp. 359–365, 1933. Summarizing these results, the range of variation within the types was as shown in the following table:—

TABLE 1.—SHOWING RANGE IN POTENTIAL HYDROCYANIC-ACID CONTENT OF VARIOUS STRAINS.

Type.	Hydrocyanic Acid in Green Herbage. Per Cent.
New Zealand mother (type 1)	0·0070–0·013
New Zealand permanent pasture	0·0030–0·007
Kentish wild white	0·0040–0·006
New Zealand ordinary	0·0010–0·003
Dutch	0·0005–0·001

Results obtained in subsequent years show that the potential ydrocyanic-acid (HCN) content during the 1932–33 season was somewhat higher than has been found since. Few samples have been ound to contain more than 0·010 per cent. HCN, and the general range, especially in respect to the types higher in HCN, is lower than is shown in the above table. For certification purposes a new standard has to be set each season by reference to control lots the performance of which is known. During the past season the lower HCN limit of those lines certified as mother-seed lines has been in the vicinity of 0·005 per cent.

It is obvious from the above statements that some seasonal variation in HCN content is likely to occur, but during the last two seasons little variation has been observed. There is a tendency towards very slight increase in potential HCN towards evening as against other times of the day, but the results obtained over a fairly lengthy period are inconclusive. In all investigations into seasonal variation it is important to have homogeneous material with which to work as some plants are likely to vary in their relative herbage-production at different times of the year. The homogeneous material on which work was carried out was secured from a single plant of white clover increased by division to give a plot sufficient for the analysis of the herbage over a period.

White clover is the only pasture-plant reported in New Zealand as containing more than negligible traces of cyanogenetic glucosides, though Yorkshire Fog (*Holcus lanatus*) has been reported in America as liable to contain amounts likely to cause trouble to stock. It is well known that many other plants, such as sorghum (*Sorghum vulgare*) and Sudan-grass (*Sorghum sudanense*), contain large amounts of cyanoglucosides, and these though recognized as valuable fodder-plants have to be fed judiciously.

With sorghum wilting during hot, dry weather gives rise to abnormally high amounts of HCN, but wilting following cutting of the herbage allows the HCN to pass off, and in this condition the herbage becomes suitable for stock. White clover gives off its HCN on drying the cut material, but during the very hot, dry weather experienced at the beginning of the year no abnormally high amounts of HCN were recorded, rather the tendency was in the reverse direction.

There is no evidence that the amounts of HCN liable to be produced by the best strains of white clover in New Zealand are sufficient to cause any stock-poisoning. In fact, sheep and cattle have been

repeatedly grazed on almost pure stands of high HCN white clover at Palmerston North and in localities where the New Zealand No. 1 type of white clover is known to exist without any effect on the stock, and even when other low-testing white clover or grasses are available the stock usually show preference for the high-testing clover. Slugs and rabbits, however, appear to favour the low HCN testing clover rather than the high. Various calculations have been published regarding the amount of potential HCN it is necessary for an animal to eat before death from poisoning or symptoms of poisoning are observed. In most cases this calculation has been made on the basis of the lethal dose or the toxic dose of free hydrocyanic acid or potassium cyanide. This has led to erroneous conclusions, as " free " HCN and salts of HCN are quite different in effect from " potential " HCN. With the free acid the animal can absorb all the poison practically immediately, but with HCN fixed as a glucoside the free acid has to be liberated first as the cyanoglucoside in itself is not a poison. The liberation of HCN from a cyanoglucoside is often comparatively slow. The animal has the capacity of rapidly removing small amounts of HCN from its system through the breath or through the skin, and in this way can deal with quite large total amounts of HCN provided it is not given off too rapidly from the feed consumed A certain amount of the HCN taken is converted into thiocyanates, which are relatively non-toxic. The rate at which HCN is liberated in the animal's body depends on (1) the amount consumed, (2) the rapidity of eating, (3) the amount present of enzyme necessary for the breaking-down of the glucoside, (4) the time taken for the material eaten to come into contact with acid digestive juices (HCN is more rapidly liberated in an acid medium than in an alkaline one), and (5) the presence or absence of substances inhibiting the liberation of the HCN (feeds rich in carbohydrates, especially glucose, and cellulose are known to retard the production of HCN).

Seddon, in New South Wales, reached the following conclusions as a result of a great deal of work. The minimal lethal dose of a cyanogenetic plant is that quantity of the plant which contains cyanogenetic glucoside, the HCN equivalent of which is equal to the fatal dose of HCN for an animal, this depends, however, upon the presence in the rumen of appropriate enzyme in sufficient quantity. The minimal percentages of HCN which should be considered dangerous for sheep are (*a*) in fresh plant, 0·02 per cent. and (*b*) in air-dried plant, 0·05 per cent.

This " minimal " dose is based on the assumption that all the potential HCN is liberated comparatively rapidly. It is possible, of course, that the feeding of plants containing more than 0·02 per cent. of potential HCN may not produce lethal effects due to possible insufficiency of enzyme or to some retarding effect of the contents of the paunch on the splitting of the glucoside. It may be taken with safety that a plant containing appreciably less than 0·02 per cent. HCN is very unlikely to produce death of the animal. The toxic dose is less than the lethal dose and is the quantity which will produce symptoms of poisoning but does not produce death. Chronic HCN poisoning is not recognized to exist, the poison not being cumulative.

From observations at Palmerston North it is obvious that white clover containing 0·013 per cent. potential HCN is not toxic.

Certain authorities consider that small quantities of cyanoglucosides, far from being a danger, are, in some cases, of definite condimental value. With reference to linseed-cake, which contains potential HCN, it has been stated: "It may well be that it owes its superiority to this small amount of HCN."

It has been suggested that bloating of animals on white clover may be associated with the HCN content. There is no evidence that high-testing white clover is any more likely to cause bloating than is Dutch white, which contains only very small amounts of cyanoglucoside. The writer, while testing clovers for HCN, observed that Dutch white clovers tended to evolve gas more rapidly than any of the other strains when allowed to digest with water in a closed flask at about blood-temperature. This observation in no way supports the contention referred to, nor does the fact that red clover, lucerne, and various other fodders contain no cyanoglucosides, yet these are very apt to cause bloat. It is well known that bloating is most frequent during the spring and in the autumn, but observations have shown that the HCN content of white clover at this time of the year is no greater than at other times. The highest figure for HCN content recorded in five years at Palmerston North was obtained at the end of January. It is conceivable, however, that when an animal is badly bloated, normally sub-toxic amounts of HCN may be sufficient to cause death.

M'Candlish, in Scotland, considers that bloating is associated with a high saponin-content and makes the observation that the saponin-content of Kentish wild white clover varies directly with the cyanoglucoside-content. This relationship apparently does not hold with New Zealand white-clover strains as these contain approximately the same HCN content at all times of the year, so that the saponin-content, by analogy, should remain at a constant level. If this is so, it would be expected that bloating should be common at all seasons.

As non-cyanophoric plants such as red clover and lucerne are known to produce "feed flavours" in cream similar to that produced by white clover the obvious inference is that HCN is not connected with the development of these flavours.

The information available, while possibly not absolutely conclusive, does not indicate that any stock trouble is associated with the cyanophoric nature of the strains of white clover being developed in New Zealand.

It is hoped to continue the investigations this coming season.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 8th August, 1935, to 22nd August, 1935, include the following of agricultural interest:—

No. 73021: Fertilizer-distributor; H. B. and L. H. Taylor. No. 73147: Fertilizer-distributor; *cognate with* No. 73021 above. No. 73214: Can-washing means; A. D. Littlejohn. No. 74049: Hay-sweep; A. C. Anderson. No. 74058: Harvesting-device; A. C and W. G. Brenner. No. 74156: Harrow; J. H. and J. T. Young. No. 74183: Removal of honey from metal container; J. F. G. Roberts. No. 74290: Tobacco-manufacture; American Machine and Foundry Co.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

EFFECT OF LIMING LEMON-TREES AT TAURANGA.

SUMMARY OF INTERIM RESULTS COVERING FIRST FOUR YEARS OF EXPERIMENT.

W K. DALLAS, Citriculturist.

EXPERIMENTAL plots were laid down in the orchard of Messrs. Mayfield Bros., Bethlehem, Tauranga, on 26th September, 1930. The object of these was to determine the effect of carbonate of lime used with a complete fertilizer. Each plot consisted of five trees, the plots being separated by buffer rows. There were four replications of each treatment. The variety of tree chosen for the test was "Lisbon" on "Sweet Orange" stock. The trees were planted in the autumn of 1921. They were then two years from the bud. The trees were planted 20 ft. apart on the square. The soil is of a light pumice type and the area flat.

Manurial Treatment.—Since the experiment was laid down all the plots have received the following dressings—(1) No lime, (2) carbonate of lime as follows. 2 tons per acre on 26th September, 1930, and 1 ton per acre on 22nd July, 1932. Both treatments were supplemented by annual dressings of superphosphate 6 cwt., sulphate of ammonia 6 cwt., and sulphate or muriate of potash 3 cwt. per acre. In the winter of 1934 carbonate of lime at the rate of 46½ lb. per tree was applied to both treatments in order to correct any increase in soil acidity caused by the sulphate of ammonia which had been previously applied This dressing was based on an application of 1½ lb. lime for each 1 lb. of sulphate of ammonia.

Range of Distribution of Fertilizer Applications. The fertilizers and lime were distributed evenly over the whole area of the respective plots right up to the trunk line of buffer trees, with the exception of an area having a radius of 4 ft. around each "plot" and "buffer" tree.

Green Manures.—Prior to the commencement of the experiment white lupins had been sown each autumn and disked under in the spring. On the 17th March, 1931, the whole area was sown with blue lupins. No difference between the lupin crops on limed and unlimed areas was noted. The crop was 18 in. in height and practically free from disease when disked in on 24th September. Blue lupins sown on 11th April, 1932, made only medium to light growth, due to frost injury, and were ploughed under in October. In the 1933 and 1934 seasons no cover crop was sown, but there was a heavy crop of weeds, which was disked under at each spring cultivation. The weed-growth was noticeably much heavier upon the limed than on the unlimed plots.

Soil Acidity.—The results of analysis of soil taken on 21st July, 1932, and 18th September, 1934, are as follows: The acidity as indicated by the pH value* of the soils is as follows:—

——	Treatments.	pH at Depths.	
		0 in. to 9 in.	9 in. to 18 in.
Samples taken 21st July, 1932 ..	Lime ..	5·8	5·72
	No lime ..	5·14	5·68
Samples taken 19th September, 1934	Lime ..	6·1	6·3
	No lime ..	5·4	6·2

* Determined by Mr. B. W. Doak, Analytical Chemist, Plant Research Station, Palmerston North.

The pH values above 5·5 can be taken as indicating slight acidity of the soil, while those below indicate a more acid condition.

Differences in pH values between the two samplings of the same treatment are due probably to natural differences as influenced by the time of sampling and partly to variation in sampling.

Crop-yields.—The following table shows the average production per tree for the various treatments since the commencement of the experiment :—

AVERAGE YIELD PER TREE IN POUNDS OF UNCURED FRUIT AND DIFFERENCES BETWEEN TREATMENTS.

Period	Dates of Picking.				Average Yield per Tree, in Pounds.		Difference in Favour of Lime (+) or No Lime (−)
					Lime.	No Lime.	
1	10/12/30	16/2/31	12/3/31	..	27·9	30·6	− 2·7
2	24/4/31	28/5/31	11/7/31	14/8/31	61·3	53·2	+ 8·1
3	24/9/31	12/11/31	12/1/32	23/2/32	121·8	109·2	+ 12·6
4	12/4/32	13/6/32	10/8/32	18/10/32	186·7	164·3	+ 22·4
5	2/12/32	7/2/33	6/4/33	26/5/33	73·2	66·9	+ 6·3
6	4/7/33	25/8/33	24/10/33	14/12/33	101·9	89·1	+ 12·8
7	21/2/34	13/4/34	12/6/34	25/7/34	111·7	89·1	+ 22·6
8	10/9/34	2/11/34	17/12/34	..	84·5	95·2	− 10·7

There are no statistically significant (*) differences between yields of limed and unlimed trees when pickings are taken in groups, as above, or in total yields.

The total yield of uncured lemons on a per-acre basis for the four years was: Lime, 83,585 lb.; no lime, 75,830 lb; the total difference in favour of the lime being 7,745 lb. per acre.

Curing.—Commencing with the picking on 24th April, 1931, lemons from each treatment were kept separate during the curing-process, and the following summary shows the weight of cured fruit as percentages of uncured, the grading of fruit, and the numbers of diseased lemons, &c., from each treatment for the period 24th April, 1931, to 2nd November, 1934.

WEIGHT OF CURED FRUIT AS PERCENTAGES OF UNCURED, GRADING, ETC

Treatment.	Cured Fruit as Percentage of Uncured.†	Percentages of Cured Fruit in Various Grades.‡			Rejects: Average Number Fruit per 100 lb. of Uncured Fruit.§
		First.	Second.	Third and Fourth.	
Lime ..	82·7	35·7	41·7	22·7	30·1
No lime ..	80·8	36·1	42·4	21·5	32·6

* "Statistically significant" means that the chances in favour of the differences being due to manurial treatment and not to chance variation are greater than 30 to 1.

† Includes green, silvered, coloured, and tree ripe.

‡ Includes green, silvered, and coloured.

§ Rejects approximately 93 per cent. blue mould, 2 per cent. brown rot, and 5 per cent. other causes from "limed" trees, and 90 per cent. blue mould, 4 per cent. brown rot, and 6 per cent. other causes from "no lime" trees.

Trunk-circumferences.—The following schedule shows the average circumferences in each treatment, together with increases,—

Treatment.	Average Trunk Circumference (Inches).				Average Increase, in Inches, 1934, over 1931.
	1931.	1932	1933.	1934.	
Lime (nineteen trees) ..	18·8	19·9	21·8	23·4	4·6
No lime (eighteen trees)	18·7	19·9	21·9	23·3	4·6

At the end of the four-year period during which the experiment has been running there is no apparent difference in the condition of the trees or of the fruit on the limed and unlimed plots. Following the applications of lime it was recorded that the texture and quality of the fruit had been improved, but this improvement was not maintained.

It is desired to acknowledge the assistance received from Messrs. A. W. Hudson (late Crop Experimentalist) and J. W. Woodcock (Crop Experimentalist) in connection with the planning of the experiments and the analysis of statistical data. Thanks are also due to Messrs. L. M. Estcourt and A. R. Grainger, Orchard Instructors, for carrying out the work on the plots, and to Messrs. Mayfield Bros. and the Tauranga Citrus Growers' Association and their staff for assistance willingly rendered. The action of Pacific Potash, Ltd., and of Imperial Chemical Industries, Ltd., in donating fertilizers, and the Department of Scientific and Industrial Research in supplying funds for other fertilizers and railages is very much appreciated.

SOUTHLAND CROP COMPETITIONS.

SUTTON CUP AWARDS, 1934-35 SEASON.

A STUART, Instructor in Agriculture, Invercargill.

THE competitions, which are under the auspices of the Southland Agricultural and Pastoral Association, are for the best swede crop and for the best turnip crop. The areas of crops eligible for competition are 4 acres of swedes and 5 acres of turnips.

The 1935 competition attracted eighteen entries for swedes and three entries for turnips, in comparison with eleven and one respectively last season. This can be considered satisfactory for the rather unfavourable growing-season experienced. Contrary to the general opinion, this season's average tonnage in swedes is equal to that of last season's entries, being 44 tons per acre.

In the swede competition, Mr. J. Grant, Bayswater, gained first place; second place was secured by Mr. W. Cavanagh, Pukemaori; and third by Mr. G. S. Young, West Plains.

In the turnip competition, Mr. R H. Dickie, Tuturau, occupied the premier position, the second and third places being filled by Mr. W. Sadlier, Woodlands, and Mr. A. O. Fleming, Mabel, respectively.

Mr. Grant sowed the variety Masterpiece in mid-November at the rate of 14 oz. per acre. Equal parts of superphosphate and bone were applied at the rate of 3 cwt. per acre. The area had been thinned and twice scuffled.

Mr. Cavanagh sowed four varieties mixed (Elephant, Masterpiece, Champion, and Herning) at the rate of 14 oz. per acre, on 15th November. A mixture of equal parts of superphosphate, Seychelles phosphate, and carbonate of lime was applied at the rate of 3 cwt. per acre. This was mixed a week before sowing. The crop was hand-thinned and scuffled.

Mr. Young sowed two varieties, Elephant and Masterpiece, about the 22nd November, at the rate of 16 oz. per acre. Five hundredweight of a mixture consisting of 4 parts Seychelles phosphate, 4 parts bone, 2 parts superphosphate, and 1 part potash salts were applied. The area was hand-thinned and scuffled twice. The swedes were "topped," and accordingly lost at least six points in yield.

Mr. Dickie sowed Aberdeen Green Top at the rate of 16 oz. per acre. The land had been prelimed with 1 ton of burnt lime, and 2 cwt. of a mixture of 2 parts superphosphate, 2 parts lime, 2 parts blood and bone, 2 parts Seychelles phosphate, and 1 part potash salts was pre-top-dressed, and 2 cwt. of the same mixture was sown with the ridger. The area was machine-thinned and scuffled three times.

Mr. Sadlier sowed Waite's Eclipse at the rate of 7 oz. per acre in mid-November. Three hundredweight per acre of reverted superphosphate was applied. The area was hand-thinned and scuffled.

Mr. Fleming sowed a mixture of Green Top and Purple Top Aberdeen at the rate of 8½ oz. per acre. The land was pre-limed with 10 cwt. per acre of burnt lime. At sowing it received 1 cwt. of Ephos and 1 cwt. of Seychelles phosphate, and ½ cwt. of potash salts applied down the front spout. The area was thinned, saddle-harrowed, and scuffled.

The points awarded to the prize-winning crops were :—

Competitor.	District.	Yield in Tons.	Husbandry.	Evenness.	Quality.	Total Points.	Place.
		Swedes.					
Grant, J. ..	Bayswater	65	9	10	19	103	1
Cavanagh, W. ..	Pukemaori	61	8	9	19	97	2
Young, G. S ..	West Plains	55	9	10	19	93	3
		Turnips.					
Dickie, R. H ..	Tuturau ..	33	9	9	18	69	1
Sadlier, W ..	Woodlands	28	9	9	18	64	2
Fleming, A O ..	Mabel ..	23	9	8	16	56	3

Evidence of the prevalence of aphis and diamond-back moth was noticeable in many crops. Damage by the diamond-back moth is a very unusual feature in Southland, and was due to this season favouring insect development.

Club-root was noticed, but in all cases was seen on the root, not on the bulb; this emphasizes the risk of following up with another cruciferous crop.

Another noticeable feature was the prevalence of the condition known as "mottled-heart," seen on cutting. This condition, known in Canada as "brown-heart," was there remedied to a great extent by applying boron compounds at the rate of a few pounds per acre

with the fertilizer employed. This disease did not appear to be confined to any particular variety, as in the above crops the following varieties were represented: Masterpiece, Elephant, Superlative, Tipperary, Crimson King, Grandmaster, Knockdon, and Suttons' Perfection.

A complaint frequently voiced by farmers met during the work of judging was the great falling-off in recent years in the yield of yellow turnips, and it would appear that this has been an important factor latterly in the falling-off of entries in this particular section of the competition.

CANTERBURY EXPERIENCE WITH SUBTERRANEAN CLOVER.*

H. NEAVE and C. H. HEWLETT, Canterbury (N.Z.) Seed Co., Ltd., Christchurch.

THE information contained in this paper is principally first-hand knowledge gained from personal experience extending over a period of six years from our own "Oakleigh" farm, on which there is an area of approximately 1,000 acres in subterranean clover (*Trifolium subterraneum*). The farm is composed chiefly of sandy loams to light shingly soils, and is situated in the Ellesmere County. The information which follows should be of some value to those farmers who have the type of land essential to the successful and economic growing of this wonderful pasture plant.

The first essentials of a fodder plant, it is said, are palatability, nutritive value, and permanency, combined with a plenteous and vigorous growth. A plant to be of the greatest value must have these attributes to a high degree. When palatability is mentioned, undoubtedly more is really meant than the word implies, and what is inferred is that, in addition to being palatable, it must also be nutritious. Now, when it is definitely stated that subterranean clover has all these attributes and many others which will be mentioned, it will be realized that it is a fodder plant which will fill a very definite place in our economic life, and which will be the means of bringing into profit large areas of land in the Dominion which are at the present time just on the border-line or are being farmed to-day at a loss. Our experience goes to show that all kinds of stock are very partial to this clover; in fact, sheep have been seen leaving an area of young Italian rye-grass and concentrating on subterranean clover. There is, therefore, no doubt as to its palatability, and, it may be added, its nutritive value, as stock thrive on it. With regard to its permanency, it has been under observation during a period of six years, and every area has to-day, without exception, a better stand than at any other period during that term, notwithstanding the fact that the part of Canterbury in which the areas are situated has for the past six years experienced exceptionally dry conditions over lengthy periods. The other essential for a pasture plant, that of a full and vigorous growth, is verified by the fact that although it has been sown in conjunction with white

* Paper presented at the 4th Conference of the New Zealand Grassland Association at Christchurch, August, 1935.

clover and cow-grass, with perennial rye-grass and cocksfoot, it has given a greater bulk of feed than any of the other plants mentioned, has certainly proved more permanent than the first three named, and is the only one which has shown a continuous growth throughout the winter. It has been found at "Oakleigh" that subterranean clover dries off earlier in the summer than the other pasture plants mentioned, but, given reasonable moisture in the autumn, it will throw up a marvellous growth again and will continue to do so throughout the winter. There is also considerable value in the aftermath; the plant, being a very prolific seeder and the seed itself being of an oily nature, stock thrive on this plant in its dry state.

Subterranean clover thrives on land of a sandy nature with a good open subsoil, but it also adapts itself to light shingly soils, and it is in each of these types of land where its true value lies. There must be in this Dominion tens of thousands of acres of land as described, and in Canterbury in particular this type of land predominates, so there is ample scope for the use of this clover. Naturally, the better the land the bigger the crop, but it is on the poorer lands that this pasture plant will prove of greater value than any other clover, and it is this point it is considered advisable to emphasize.

Experience shows that early autumn is the best time in Canterbury for sowing, and February or early March has given the best results. In these months surface-sowing is preferable, but should the sowing be delayed to a later period, it always has been found on the light sandy soils that drilling gives better results, owing chiefly to the fact that frosts do not injure the young plants to the same extent as in the case of surface sowing. The importance of sowing in early autumn is emphasized, as this gives the plants more time to establish their rooting-systems, after which the plant will be in a position to throw up a good vigorous growth in the spring. A light grazing only during the first season is strongly recommended; a heavy grazing is strongly condemned, particularly during the flowering period. The reason for this is obvious, as subterranean clover, being an annual, must have an opportunity of maturing in order to be in a position to perpetuate its kind. In our opinion, most of the failures in the successful growing of this pasture plant may be attributed to injudicious feeding during the first flowering period. Though this clover is an annual, it has certain characteristics which make it superior to an ordinary annual, and in a sense more perpetual than a perennial, for it buries its seed-head in the ground and thus makes every effort practicable to re-establish itself. It has also another method of perpetuating itself, which is accomplished in the following manner. In almost every instance each seed-head contains three seeds, and of these, two germinate the first season and the remaining seed does not germinate till the following year. This is just another way of Nature's coming to the rescue, for if for one reason or another the first two seeds do not reach maturity there is always another one left to keep the flag flying. Now this is brought about by Nature supplying the remaining seed with an unusually hard skin, which apparently protects and controls the germ for a longer period. In the seed trade it is not uncommon to find in some samples of white clover, and in lucerne in particular, a varying quantity of what is termed hard seed; and we offer the suggestion

that possibly this is after all another example of Nature's way, and what we may have regarded as a very serious fault, may, in fact, be a blessing in disguise.

Several different mixtures have been used in sowing down, and one of cocksfoot and subterranean clover has given the most satisfactory results. One cannot lay down any hard and fast rule as to the respective quantities of each, but a mixture of from 10 lb. to 12 lb. of cocksfoot and from 2½ lb. to 3 lb. of subterranean clover sown with 44–46 per cent. superphosphate at the rate of 1 cwt. per acre has been quite satisfactory, and in the course of twelve months with judicious treatment this will form a very dense sward of highly nutritious pasture. It has been found that one application every second year of a dressing of 1 cwt. 44–46 per cent. superphosphate made in the late autumn is very beneficial, not very costly, and the subterranean clover responds very rapidly to this treatment.

In Australia workers are concentrating on the early-maturing varieties, such as Extra Early Dwalganup, the reason being that in the later varieties—*e.g*, that known as Mount Barker—it is found that owing to the excessive heat prevailing over a large area of the Continent the plant wilts and dies before the seed matures, thereby becoming extinct. With the very early varieties the plant is sufficiently matured before the hot weather sets in In New Zealand the later varieties such as Mount Barker would, it is thought, be of much more value, as they would give a longer growing period, in the hottest and driest periods in Canterbury the plant has always matured and formed its seed quite satisfactorily. If a series of trials could be carried out with different varieties to ascertain those most suited to New Zealand conditions in different localities the work should be of considerable value. We are sowing a small area with a mixture of the earlier variety with that of the Mount Barker to test the possibility of spreading the grazing of the pastures over a longer period.

A further feature of some moment is the fact that this plant is a wonderful soil-improver, and in localities where subterranean clover has been sown down for a number of years the texture of the soil shows a marked improvement, and from that point alone this plant is doing wonderful service It is possible that in the course of years the physical condition of these lighter soils may be sufficiently improved by subterranean clover to enable them to carry white and red clovers.

In this paper it is desired to advocate the use of subterranean clover not for the heavier types of soils where white and red clover holds, but for only those lighter types of soils where white and red clover does not hold.

In conclusion, it may be said that until five years ago the whole of that 1,000 acres at " Oakleigh " was down in native grasses and tussock, and had not subterranean clover been available to sow down with the rye-grass and cocksfoot it is considered that the two latter grasses would not have held, but that the land would have reverted to native grasses with their lower carrying-capacity.

Pursuant to the Agricultural and Pastoral Societies Act, 1908, the Putaruru District Society has been incorporated.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR THE YEAR 1934–35.

LISTS of butter and cheese manufacturing companies (co-operative and proprietary) which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1934, to 31st July, 1935—are given below.

Butter-factories included in this list number ninety-seven, seventy-eight being situated in the North Island and nineteen in the South Island. No less than thirty-four of these averaged over 94 points, the highest individual average being 94·904.

Fifteen cheese-factories obtained a place in the list. Of this number, nine are located in the North Island and six in the South Island.

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
		Butter-factories.		
Rangiwahia-Ruahine	750	Quail	182	94·904
Awahuri	664	Red Rose	809	94·807
Golden Bay	146	Sovereign	622	94·771
Levin	910	Lake	1,311	94·716
Kaikoura	302	Kai	167	94·673
Kokatahi	1144	Kokatahi	154	94·632
Wangaehu	1326	Wangaehu	605	94·601
Arahura	1516	Arahura	75	94·585
Shannon	1489	Shannon	1,141	94·580
United	1296	Whariti	170	94·543
Lepperton	49	Lepperton	114	94·538
Taieri and Peninsula	54	Peninsula, &c	19	94·506
Tikorangi	102	Shield	434	94·467
Uruti Valley	360	Uruti	269	94·466
Midhirst	110	Rugby	1,351	94·448
Inter-Wanganui	6	Inter-Wanganui	186	94·436
Rangitikei	1360	Rangitikei	707	94·392
Collingwood	1254	Golden Hills	207	94·366
Rata	938	Rata	1,090	94·283
Mangorei	345	Mangorei	850	94·277
Rongotea	8	Rongotea	865	94·268
Tamaki	1463	Bell	360	94·267
Tarata	631	Tarata	135	94·225
Maketawa	342	M.D.C.	279	94·212
Masterton	1307	Masterton	653	94·164
Kaitaia	1298	Kaitaia	1,803	94·161
Ruawai	66	Ruawai	1,659	94·154
Omata	82	Omata	501	94·152
Tarurutangi	728	Champion	97	94·136
North Taranaki	723	Flax	827	94·132
Moa Farmers'	341	Inglewood, Heath	1,397	94·063
Bell Block	488	Bell Block	168	94·040
Okau	872	Okau	228	94·040
Stratford Farmers'	68	Stratford	1,121	94·013
Waitara	726	Waitara	512	93·989
Golden Coast	387	Golden Dawn	36	93·979
Northern Wairoa	4	Northern Wairoa	694	93·909
Karamea	1570	Karamea	188	93·891
Wairoa	1345	Wairoa, Clyde	621	93·842
Kairanga	1768	Longburn	556	93·804

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Butter-factories—*continued.*				
Norsewood	600	Norsewood	948	93·782
Apiti	414	Apiti	328	93·742
Whakaronga	1709	Whakaronga	168	93·739
Westland Cold Storage and Dairy Co.	145	Westland	126	93·730
Eketahuna	46	Eketahuna	109	93·728
Cheltenham	3	Pakeha	2,425	93·710
Wellington City Corporation Milk Department	202	Rahui	84	93·694
Okoia	413	Okoia	1,125	93·691
Kaikohe	40	Kaikohe	307	93·654
Mauriceville	14	Mauriceville	779	93·649
Murchison	1888	Airship	180	93·646
Northern Wairoa	1358	Northern Wairoa	2,069	93·645
Tolaga	1007	Tolaga Bay	217	93·637
New Zealand Farmers' Dairy Union	100	Hinemoa	1,071	93·584
Mokau	274	Mokau	187	93·570
Waitoitoi	20	Waitoitoi	96	93·557
West Coast Farmers'	675	Silver-pine	34	93·545
Rotokare	248	Westown	26	93·537
Maungaturoto	1407	Otamatea	1,031	93·513
Tariki	1818	Tariki	320	93·504
Te Aroha - Thames Valley	344	Overseas	2,108	93·485
Rodney	394	Rodney	580	93·483
Opotiki Dairy Association	337	Opotiki	1,645	93·394
Ngatiporou	395	Nati	639	93·391
Kia Ora	926	Kia Ora	1,454	93·385
Morrinsville	330	Lockerbie, &c.	2,898	93·370
Waikato Valley	297	Waikato Valley, &c.	4,831	93·351
Katikati	1305	Katikati	705	93·316
Alpine	792	Pine	25	93·316
Kaipara	794	Poplar, Filbert	2,168	93·312
Piopio	603	Piopio	562	93·308
Heretaunga	1230	Heretaunga, &c.	1,146	93·302
Kuku	905	Ohau	147	93·290
Whangarei	1720	Kauri, Taipuha	2,829	93·287
Farmers' Dairy Federation	165	Murihiku	163	93·275
New Zealand	1238	Anchor, Acorn	2,037	93·260
Eltham	31	Eltham	834	93·258
Tai Tapu	175	Tai Tapu	754	93·250
Matakana	1375	Matakana	244	93·243
Whenuakura	1237	Whenuakura	216	93·204
Albertland	298	Port Albert	816	93·194
Taihape	1188	Tikapu	594	93·189
Featherston	360	Featherston	106	93·170
Tauranga	1478	Tauranga	1,357	93·155
Manakau	815	Manakau	207	93·155
Arawa	1887	Arawa	767	93·134
Golden Coast	991	Golden Coast	158	93·130
Raglan	1470	Raglan	454	93·117
Patua	73	Patua	82	93·101
Raetihi	717	Raetihi	301	93·097
Canterbury Central	55	Fern-leaf	640	93·077
Waipu	1248	Waipu	560	93·049
Rangitaiki Plains	133	Rangitaiki Plains	3,643	93·048
Hinuera	329	Hinuera	1,150	93·039
Konini	1203	Konini	473	93·025
Waitaki	1013	Waitaki	138	93·012
Co-operative Dairy Co. of Otago	266	Otakou	405	93·003

Company or Proprietor.	Registered No.	Brand.	Tonnage graded.	Average Grade.
Cheese-factories.				
Omimi	74	Omimi	68	93·587
Kaimata	992	The Oaks	357	93·449
Otamita	17	Otamita	102	93·417
Gorge Road	507	Gorge Road	146	93·366
Wellington Farmers' Dairy Association	252	Onward	100	93·362
Newall	86	Newall	372	93·334
Rai Valley	519	Rai Valley	250	93·207
Kaitangata	1648	Kaitangata	123	93·204
Lepperton	49	Lepperton	255	93·150
Waitohi	483	Waitohi	122	93·086
Lowgarth	629	Lowgarth	552	93·080
Kaponga	1696	Rowan	376	93·074
Jolls	487	Maori Chief	382	93·044
Kaiparoro	619	Bruce	187	93·010
Elmdale	1721	Elmdale	231	93·000

The Instructor in Agriculture, Whangarei, reports that a dressing of two tons of lime an acre has given outstanding results on the ironstone (laterite) soils at the Bay of Islands.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING AUGUST, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture The list supplements that published in the July and August *Journals*, and refers to those crops passed during August. Further tests will be published in later issues.

In the May *Journal* was published a list of growers who have received provisional certificates. The acreage, percentage of foreign varieties present, and the classification and group number representing the relative merits of lines were given in the list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—

Barnett, R , Dunsandel.
Barr, H C , Prebbleton-Springston, R.M.D.
Basher, W. F., care of F. E Larcombe, Springston, R.M.D.
Breitmeyer and McFarlane, Little River (Line B)
Burgess, R. W., care of F Merrin, Eyreton-Kaiapoi, R M D
Caldwell, G., Courtenay, R.M D.
Carroll, Mrs. A , Southbridge
Carroll, J , Southbridge
Carroll, T. F , Southbridge
Cross, A. E , " Pine Farm," Bennett's, via Rangiora (Line B)
Foster, T C , Ladbrook's, R M.D (Line A)
Foster, T C , Ladbrook's, R.M D (Line B)
Foster, T C , Ladbrook's, R M D (Line C).
Gilbert, D R., East Oxford.
Hegan, J , and Son, Southbrook (Line A)
Heron, F , Rangiora, R.M.D.
Kenyon, F., Mina, North Canterbury (Line A).
King, G. H , West Belt, Rangiora.
Marton, W. E , Kaiapoi, R.M D. (Line B).
Matson, A. L., Box 3, Christchurch (Line A).
Matson, A. L , Box 3, Christchurch (Line B)
Morgan, D., R.M.D., Cheviot, North Canterbury.
Nairn, G., Lakeside-Leeston, R.M.D. (Line A).
Petrie, J., sen., Swannanoa, R.M.D.
Poulton, A. D., West Eyreton, R.M.D.
Purvis, G., Oxford Road, Rangiora.
Rangiora High School, Rangiora (Line B).
Roper, R. S , Halkett, R.M.D.
Royds, G. E., 12 Burnside Road, Fendalton, Christchurch (Line A).
Schluter Bros., Rangiora.
Thomas, J. W., Gray's Road, Upper Fendalton, Christchurch.

AUCKLANDER SHORT TOP—*continued.*

Commercial Seed—

Adams, K. and R., Sheffield.
Boyle, A D , Orari.
Burrell, T. F , Levels, South Canterbury.
Haines, C., 108 Waimak Road, Harewood
Ham, A , Grovetown, Blenheim
Royds, G. E., 12 Burnside Road, Fendalton, Christchurch (Line B)
Royds, R. S , 12 Burnside Road, Fendalton, Christchurch (Line B).
Seivwright, R M., " Meadows," Washdyke.
Sharlick, J., Marshlands Road, Ouruhia, Christchurch
Shillitto, R. S., 135 Armagh Street, Christchurch.

DAKOTA.

Mother Seed—

Allen, A , R M.D., Leeston
Barnett, R., Dunsandel.
Boyce, A., Doyleston.
Campion, C. A., Highbank, Methven.
Cherry Bros., Kaiapoi, R.M.D
Cross, A. E , Pine Farm, Bennett's, via Rangiora.
Cross, H. E , Sandy Knolls (Line B).
Johnston, H. W., Dunsandel
Johnston, R. H , Dunsandel.
Marshall, D , Killinchy - Leeston, R.M.D
McCartin, J., Leeston.
Nicklaus, J. F., 104 Ryan's Road, Upper Riccarton, Christchurch.
Petrie, J., sen , Swannanoa, R.M D.
Phillips, A. G., Weedon's, R M.D.
Robinson, R. P., Waikuku.
Rolston, G., Weedon's - Greendale, R.M D.
Royds, R. S., 12 Burnside Road, Fendalton, Christchurch (Line A).
Wolff, R. G., Horrelville, R.M.D.
Wright, Q. A., Annat.

Commercial Seed—

Ballantyne, C. T., Gleniti, Timaru.
Burrowes, J., Chertsey, Mid-Canterbury (Line B).
Smart, L. E., Box 3, Lincoln.
Thomas, D., Springston.

ARRAN CHIEF.

Mother Seed—

Anderson, A., Stirling.
Court, R. T., Swannanoa, R.M.D.
Dobbie, R, Menzies' Ferry.
Wright, Q. A., Annat.

Commercial Seed—

Barnes, W., and Son, 199 Highstead Road, Styx.
Henderson Bros., Otapiri, R.M.D., Winton.
Leech, C., Rangiora.
Manson, D, Enfield, Oamaru (Line B).
Morrison, J. L, Morven.

ARRAN BANNER.

Mother Seed—

Amyes, H G., "Riversleigh," Annat.

Commercial Seed—

Robinson, R. P., Waikuku.
Roper, P. F., Halkett, R.M.D.

KING EDWARD.

Mother Seed—

Anderson, A., Stirling (Line A)
Anderson, A., Stirling (Line B)

AUCKLANDER TALL TOP.

Mother Seed—

Frost, C. H., Balcairn P.O.
Thomas, S., West Belt, Rangiora.

Commercial Seed—

Roper, R. S., Halkett, R.M.D.

MAJESTIC.

Mother Seed—

Cross, H. E., Sandy Knolls.

AMERICAN WONDER.

Mother Seed—

Wright, L T., Annat.

ARRAN CONSUL.

Mother Seed—

Piner, E., Annat, R.M.D.

BRESEE'S PROLIFIC.

Mother Seed—

Marshall, D., Killinchy, Leeston, R M.D.

INVERNESS FAVOURITE

Mother Seed—

Piner, E., Annat, R M D.

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Feeding Efficiency and Special Crops.

In general, the valuable role of special crops to supplement the pastures on arable land in districts of relatively light rainfall is well recognized, even though this fact at times is not reflected adequately in practice. But opinions about the role of special crops to supplement pastures in districts of good rainfall, say, 30 in. or more annually, have not been stable In such districts a few years ago the farmer who could say he had not a single acre under the plough was looked upon by many as having attained a high standard of efficiency in grass farming, but more recently the trend of opinion among farmers has favoured an increased acreage of forage crops to supplement pastures during the periods of their scant growth. That this trend in the views of farmers is well founded in respect to dairying generally may be seen readily from a consideration of the relationship between the feeding and the production of dairy stock. A study of the data available from herd-testing and factory returns reveals that in the ten months of greatest yield the production of a herd fed at the average standard of efficiency is six to seven times that of the December production, whereas the corresponding production of a well-fed herd of reasonably good producing-capacity is eight to nine times that of the December production The greatest differences in the results from the two standards of feeding occur in the early part of the lactation period, and from this it is clear that the feeding during the winter-early-spring period particularly is at fault. To cite an illustration, in the case of a herd of high production, for every 100 lb. of butterfat produced in December, 397 lb. of butterfat were produced prior to December , whereas in the case of average herds, for every 100 lb. of fat produced in December, 286 lb were produced prior to December—a substantial difference of 111 lb. of butterfat a cow for the four months August to November It is to be noted that this difference arises during a period when the inherent persistency in production of the animals normally does not affect the yields. As a rule, a substantial difference arises also in the latter part of the lactation period. In some instances this difference is due in part at least to differences in the inherent persistency in production, but generally it is due to differences in the degree of efficiency in feeding: the circumstantial evidence provided by "good" late summer and autumn conditions when the universal supply of feed naturally available is particularly good strongly supports this contention, because during such periods of natural abundance of feed the production of herds customarily of low yield often approximates that of reputedly superior herds.

The facts just outlined point to the practical conclusion that, without altering the quality or size of the existing herds, dairy production could be increased by 25 per cent. or more simply by increased efficiency in feeding.

Basic Weakness in Pastures as Sole Direct Source of Feed.

The position as described arises from a basic weakness in pastures as a sole direct source of feed throughout the year. This weakness becomes strikingly apparent when the seasonal feed-requirements of a typical well-fed herd of good annual production are compared with the seasonal production of feed by grassland in districts of good rainfall. The following enlightening comparisons relate to a herd of seventy-eight cows of an average

yield of 391 lb. of butterfat and to the weighed production of well-managed grassland at Marton Experimental Area over a period of three complete years :—

(a) During June to September inclusive 292 lb. of feed were required for each 100 lb. required in December, whereas 123 lb. of feed were produced for each 100 lb. produced in December.

(b) During February to May 326 lb. of feed were required for each 100 lb. required in December, whereas 75 lb. of feed were produced for each 100 lb. produced in December.

Taking the whole year, the position was found to be as follows :—

(a) Under utilization of pastures designed to spread the supply of feed as evenly as possible, from 68 per cent. to 77·5 per cent. of the year's production of feed took place in October to January inclusive and from 22·5 per cent. to 32 per cent. in the remainder of the year.

(b) An efficiently fed herd of good production required 39·5 per cent. of the total year's feed-supply in the period October to January and 60·5 per cent. during the remainder of the year.

In short, the seasonal supply of feed was broadly the reverse of the seasonal requirements of feed.

The Position in Sheep-farming.

Much of what has been said up to this stage has referred to dairying. Dairying certainly presents the stronger case for special arable cropping . this is because dairying is faced not only with a critical winter-early-spring period as is sheep-farming, but also with a critical later-summer period during which the sheep-farmer obtains much relief by the disposal of, say, fat lambs.

But the ultimate success of much sheep-farming, as of dairying, is founded upon the milk-supply, and, this being so, the feed requirements in sheep raising parallel, in essential features, those of dairying. The control of parasites of sheep enters as an additional factor of considerable moment. Hence in practice a close association between special arable cropping and uniform marked success in sheep-raising is often to be found.

How Top-dressing influences the Seasonal Feed-supply.

It may be thought that a more even supply of feed throughout the year would result from judicious top-dressing, but data obtained from investigational work shows that, apart from special nitrogenous top-dressing, top-dressing actually broadens appreciably the absolute gap between winter production on the one hand and late-spring or early-summer production on the other hand : in one typical case the gap in the daily production per acre between October production and May to August production was 111 lb. when no manure was applied, whereas it was 168 lb. when 3 cwt. of superphosphate an acre was applied in the autumn.

Remedying the Position.

There are two main schools of thought relative to the method of remedying the position.

One advocates dependence mainly on ensilage and hay-making and frequently suggests also the exploitation of such auxiliary practices as nitrogenous top-dressing and the use of special pastures to give feed when pastures normally fail—*e.g.*, special paspalum or cocksfoot and red-clover paddocks for summer and special subterranean-clover paddocks for winter and early spring. Though definite knowledge about the general utility and economic standing of these auxiliaries seems to be scant, it may be granted that they could be employed at times with advantage, and this more frequently than they have been employed in the past.

Relative to the role of ensilage the following statements are submitted as a summary of the position :—

(1) In districts of good rainfall on the majority of the dairy-farms devoted dominantly to pasture ensilage should be practised, and it could also be introduced advantageously into the work of a much greater number of sheep-farms than now practise it.

(2) Widely and often the mid-January to mid-March period is a critical one for which silage of the sort commonly made is far from ideal as a supplement to pastures in the rations of dairy cows.

Further, it is extremely doubtful whether there is any justification for an attempt to induce farmers generally to produce a different type of silage—one made from much more leafy and immature herbage would be needed to meet the late-summer feed requirements in dairying.

That supplies of silage of the type generally available have distinct limitations as a summer feed for dairy cows was rather freely illustrated during the 1935 summer, when, because of the dry season, greater use than usual was made of it.

(3) The most inexpensive way of harvesting the pasture crop is that which dispenses with special labour and equipment—*e.g.*, grazing.

(4) The least wasteful way of harvesting the grass crop is grazing: account has to be taken of the wastage due to fermentation, leaching, &c., in both ensilage and hay-making.

(5) Grazing ordinarily is more compatible with the continued welfare and possible improvement of the swards on an economic basis.

(6) Even if silage were entirely suitable as a supplementary feed, it would not be at all easy to build up reserves of it adequate to give a full measure of safety in the event of successive unfavourable seasons.

The second school of thought allots to special crops, such as mangels, lucerne, chou moellier, an important place on many farms in districts of good rainfall, in the task of suitably levelling out the supply of feed from season to season. At the same time, normally an important place in the task is also given in ensilage and hay.

Properly planned special cropping provides a supply of feed both adequate in quantity and suitable in quality throughout the year. There is no conclusive evidence that generally this result can be obtained satisfactorily in any other way over a series of years.

Judicious special cropping provides an opportunity for the replacement of inferior pastures. Often the fact that special cropping necessitates the breaking-up of pastures is advanced as an objection to such cropping, even in relation to farms on which more breaking-up of pastures than is taking place is definitely advisable if the most economic production, irrespective of the influence of cropping, is to be obtained from the pastures. This position has been intensified by recent advances in strains of pasture plants. Even in districts in which grass farming is at the highest pitch of efficiency, farms on which no pastures could be resown with advantage are extremely rare. Hence any setting of the cost of replacing pastures as an item against special cropping is largely the creating of a bogy. In this connection it seems highly significant that in one of the best grassland districts in the Dominion the farms which have the greatest amount of really good pastures stand out in respect to the amount of arable cropping carried out on them.

When a search is made for the explanation of the association of good pastures with cropping the line of thought necessarily travels in a circle: the better the pastures the more the need for special cropping to balance the seasonal supply of feed; the more special cropping the more opportunity of basic improvement of pastures.

Suitable supplementary cropping is the necessary basis of the most effective and profitable development of the increasingly important side-line, pig-meat production. This position will be intensified with any change-over from the production of porkers to that of baconers. Often simple extension of the area required for dairying in respect to such crops as mangels, chou moellier, swedes, carrots, and lucerne would assist the pig-feed position greatly. The growing for pigs of additional crops such as barley and peas is often well justified.

Special cropping also reacts favourably in the important task of breeding replacement stock.

It is advanced against cropping that it involves additional outlay in equipment and horses and the keep of working horses. Probably this is of less moment than is sometimes thought. In the 550 North Island dairy-farms reviewed in the report of the Dairy Industry Commission there were 2·61 working horses per farm. Incidentally there were more horses per farm and fewer acres of farm per horse in the districts in which least arable cropping was done. In the different subdivisions of the Auckland Land District there was one horse to each 38 to 43 acres; in Taranaki there was one horse to each 50 acres; over all the farms there was one horse to each 47½ acres. Against this position is to be set the fact that in the Auckland Land District 1 acre of arable crop was grown to every eleven dairy cows, whereas in Taranaki there was 1 acre of arable crop to every nine cows.

The average capital value of the implements per farm is enlightening. It did not differ materially from district to district. It amounted to £157 per farm. This value seems sufficient to meet most of the needs of the relatively modest arable cropping programme desirable for herds of from fifty to seventy cows. It would seem then, that in respect to horses and implements, arable cropping generally presents no substantial difficulties.

The foregoing considerations either singly or together do not form a complete case either for or against the advisability of supplementary cropping In fact, some of the decisive considerations have not been mentioned.

Labour-supply an Important Consideration.

One of these is labour. The position summed up is: If supplementary cropping can be done by the labour already employed regularly on a farm without bringing about neglect of some other essential farm task, then it will prove profitable to do the supplementary cropping. But as the amount spent directly on hired labour for cropping increases, the profit from the cropping tends to decrease until a point may be reached when a greater net profit would be obtained by dispensing with the cropping even though the cropping itself is profitable. As an instance, one may cite two similar farms of 60 acres. One was wholly in grass. On the other production was driven up by from 35 lb. to 40 lb. of fat an acre by cropping. The returns from the additional butterfat largely were eaten up in costs of cropping, which necessitated the employment of an additional adult farm hand. But such cases are not general. Further, and this is of great practical importance, they can be obviated usually if the additional labour is utilized fully and judiciously. In the case cited, if the pig-production potentialities of the place were exploited to the further extent that the additional labour allowed, the additional pig returns would have recouped much of the additional labour outlay and thereby set the position right.

On the farm wholly in grass one man with a small amount of help from his family handled about 40 cows, and cropping would have necessitated an additional adult. While such a farm is of importance as an illustration of the important bearing of labour considerations, it seems well to emphasize that it is not illustrative of the general position. This may be gleaned from

the fact that the number of cows generally handled per labour unit is approximately twenty-one (Report Dairy Industry Commission). With such a labour-herd relation time for cropping normally is available.

Bearing of Weather, Weeds, &c.

A second factor which determines the advisability of supplementary cropping embraces soil and weather conditions upon which reliable and economic yields depend. One illustration of this is the sandy Wellington–West Coast belt. One cannot but approve of the practice of some farmers of this belt who employ lucerne for summer and subterranean clover for winter as substitutes for arable cropping, and this with considerable success. Another important illustration is provided in parts of North Auckland, where there is a combination of heavy soils and abundant rainfall which militate against constant success with arable crops.

A third important factor determining the advisability of arable cropping is the weed position—*e g.*, Californian thistle may so militate against successful results being associated with arable cropping as to be the deciding factor

The Potato Crop.

In many districts the main crop of potatoes should be sown in October. The use of unhealthy seed is probably more productive of unsatisfactory yields than the joint effect of all other factors which bring about decreased production The most serious type of disease is "virus" disease, which is borne in the tubers in which it cannot be detected by the eye, although it can be detected readily in the foliage. Hence it is impossible to tell by inspection of "seed" whether or not it is reasonably free from virus, and because of this the only safe course is to use certified seed— *i.e* , seed which has been passed under the official system of certification. The cutting of seed potatoes at times leads to many blank spaces in the rows of the resultant crop due to the rotting of the cut portions. Rotting is greatly lessened if the conditions are suitable for the healing of the cut surfaces. Dry conditions in particular do not favour healing Hence, while it is good practice to cut and plant immediately into a moist soil, it is not good practice to leave cut potatoes in sunlight or to plant them at once into dry soil. Special care needs to be taken in regard to Auckland Short Top, Aucklander Tall Top, Majestic, and King Edward, which do not heal readily after cutting If cut potatoes are to be kept for a day or two they should be stored in a moist place or covered with wet sacks

General Work.

It is inadvisable to omit treating cereal seed suitably for the prevention of smut. Unless seed-treatment is carried out properly, it is very likely either to cause serious injury to the seed or to be ineffective as a means of controlling disease

September is often a suitable month in which to close up areas of lucerne. Early closing tends to result in an extra cut being obtained annually, and also in minimizing the damage caused by invading plants which outgrow lucerne early in the season.

It is often worth while to sow in October an area of quickly maturing soft turnips, such as Purple-top or Mammoth, for use early in the New Year: while the yield from such an area may not be heavy, it is likely to be valuable in avoiding an unduly rapid and early falling-off in butterfat-production commencing at about the New Year.

Kales, including chou moellier, have been sown with good results in October: such sowings have provided feed in February. Later sowings may well be made for use in the autumn and winter.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Pest and Disease Control.

Before these notes appear a commencement will have been made on the seasonal spraying programme, and this major work will now be receiving the close attention of all growers. The base spray of Bordeaux (5–4–50) should already have been applied, as also should the winter-oil spray for the control of scales, red mite, &c. Thoroughness of application should not be lost sight of by growers, and strict attention to this matter will save considerable expense and avoid disappointment during the season.

The base spray having been applied, attention should be given to the cover sprays. A point to bear in mind is that "prevention is better than cure." The aim should be to obtain complete and continuous coverage during the period disease is active. It should be remembered that at this period of the year there is a rapid increase of leaf surface, together with shoot-extension and development of buds and fruit, and that failure to maintain efficient coverage may be the means of disease getting out of control and may involve the orchardist in considerable expense to bring it again under control

It is not advisable, irrespective of weather conditions, to follow the practice of spraying at fixed "stages." In the early part of the season when growth is active and when, because of the weather conditions infection from fungous diseases is on the increase, the grower should arrange his spray applications so that the intervals between sprays are not of such length that new growth is left unprotected for any great length of time or beyond the period of efficacy of the previous spray. A point to note is that the effective period of coverage of lime-sulphur and other sprays following application at this period of the year under favourable conditions is approximately ten days. Weather conditions should also be taken into account, and the frequency of applications must be determined by the grower with the foregoing points in mind.

Stone-fruit trees should now be receiving protective sprays against brown rot, shot-hole, peach-scab, &c., and lime-sulphur at 0·083 per cent plus colloidal sulphur 2 lb. to 100 gallons is recommended This should be applied at petal-fall, and if blossom infection of brown rot has occurred, or if unfavourable weather is experienced, should be repeated after an interval of ten days, otherwise in three weeks

For pears Bordeaux (3–4–50) is recommended, with the addition of arsenate of lead 1½ lb. to 100 gallons of spray following petal-fall, excepting on tender, clear-skinned varieties, when lime-sulphur, 0·1 per cent., should be substituted for the Bordeaux.

For the present month, on apples lime-sulphur 0·2 per cent may be used up to the blossom period, to be followed by lime-sulphur 0·1 per cent. plus colloidal sulphur 2 lb. and arsenate of lead 1½ lb. to each 100 gallons in combination at petal-fall, and repeated in from ten to fourteen days. Where powdery mildew is very prevalent an application of lime-sulphur should be made at the "pink" period. It is also advisable to increase the amount of colloidal sulphur from 2 lb. to 3 lb. in the combination spray.

In preparing the combination spray of lime-sulphur, colloidal sulphur, and lead arsenate, the addition of 3 lb. of hydrated lime per 100 gallons of spray retards the chemical reaction between the lime-sulphur and arsenate of lead, usually characterized by the spray mixture turning black. In preparing this spray the lime-sulphur should be added to the tank as it is being filled with water, followed by the colloidal sulphur, and then the hydrated lime and arsenate of lead creamed together and added finally with the agitator running.

A watch should be kept for the first appearance of the nymphs of the apple-leaf hopper, and nicotine sulphate 40 per cent. at 0·05 per cent. (1–800) should be added to the combination sprays for control. This will also assist in keeping in check the red mite. Nicotine sulphate at same strength should also be used at the first appearance of aphides. When this specific is to be used alone, the addition of soft soap 4 lb. to each 100 gallons of spray is recommended, otherwise it is largely non-effective. The soft soap should be dissolved in 4 gallons of warm water to which is then added the requisite amount of nicotine sulphate. This should stand for twenty minutes before being added to the spray tank of water.

The russeting of fruit was a serious problem to growers and especially so to exporters last season. It appears that pip-fruits are most subject to russet between the advanced "pink" stage to the "calyx" stage. The trouble seems to be induced largely by seasonal conditions. A cold wet spring, particularly if the unfavourable conditions coincide with the period between advanced "pink" and "calyx," appears to cause russet, the trouble being further accentuated by sprays applied during this period of fruit-development. With warm favourable conditions during this period russeting is usually almost non-existent. Where Bordeaux sprays have been applied late in the season there is a possibility of their coming in contact with the young fruits and causing russet, and it is therefore wise to apply them sufficiently early to avoid this.

Cultivation.

Where spring ploughings are being made they should be completed as early as practicable and the summer cultivation commenced. The early aeration of the soil greatly assists the early and active increase of the beneficial soil bacteria, which play such an important part in soil fertility. Furthermore, the maintaining of a good soil tilth assists in the retention of soil moisture during dry periods, and largely minimizes the ill effects, both to the tree and to the fruit crop, of drought conditions. The ground should not be allowed to harden and crack, but should be stirred as soon as practicable following rain.

Manuring.

The application of phosphatic and potassic manures should not be further delayed. The first application of a nitrogenous fertilizer should now be made, followed by a further application two months later. It generally is accepted that the application of manures should be at the rate of 1 lb. of a balanced manure to each case of fruit produced per tree. The nitrogenous content should be increased for debilitated trees and decreased for over-vigorous trees.

R. G. Hamilton, Orchard Instructor, Hamilton.

Citrus Notes.

Owing to the continued wet weather every opportunity should be taken to keep the soil surface directly under the trees well stirred to give sufficient aeration to prevent the development of brown rot. In addition to this, all branches which are inclined to brush the soil should be removed. An application of Bordeaux mixture (3–4–50) to coincide with the blossom-fall of the main crop acts as a protective spray against brown rot and verrucosis. Adequate drainage is also very essential to the health of citrus trees, especially during such a wet season as is at present being experienced. Growers should also be prepared for the possibility of a late frost, which is likely to follow when the weather takes up, and those growers who have equipped their groves with fire-pots should see that everything is in readiness.

Manuring.—The application of nitrogen to the trees should be delayed until the period of frost danger is past, but a dressing of sulphate of potash may assist in increasing the resistance of young growth to injury.

In the case of newly established plantings, every chance should be given the trees to develop; all shoots not required to form the frame of the tree should be rubbed off, and any strong perpendicular shoots should be cut out to encourage side growth. Any planting still to be done should be completed as soon as possible, so that the trees can become established before the hot weather commences.

Spraying.—As soon as the trees are in active growth there is little danger of damage to the foliage by the use of a summer-oil spray for the control of scales and other sucking insects. As soon as the young growth has hardened an oil emulsion can be applied. Summer oils at a strength of 1–33 for red scale and 1–80 for other sucking insects are now generally preferred, as there is less danger of damage to foliage than when the winter (red) spraying oil is used, and they give a much more effective control. If thrips are in evidence spraying with nicotine sulphate (1–800) is necessary, this may be combined with the spring spray of Bordeaux (3–4–50) applied for the control of verrucosis and grey scab.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Time of Hatching.

UNTIL recently, September was considered rather early to hatch chickens of the light breeds, but now-a-days most of the larger poultry-farmers aim to have their last hatch out before the end of this month.

Where the natural method of incubation is depended upon, it is not always possible to get broody hens when required, and quite a few poultry-keepers, who rear only a few pullets each year, wait until certain hens known to be good setters become broody. As a rule such hens as they get older take longer to come on to lay, with the result that each year they are later going broody. In such cases, where Leghorns comprise the main flock, and only a few of a heavy variety are kept for setting purposes, it is a good plan to rear a few heavy-breed pullets each year to take the place of the older broody hens.

Experience has shown that September is the best month in which to hatch out the light breeds, and therefore every effort should be made to secure the number of chickens required before it is too late.

On many plants which have been visited beginners, being anxious to build up their flock to a certain number of pullets, during the first year have hatched later than their more experienced neighbour would. The result has invariably been that the late-hatched pullets, instead of being an asset, have proved a liability, having eventually to be culled out and sold at a loss. It is a much wiser plan to take as an example the successful man who has proved his knowledge, and who will not hatch after a certain date even if he has not obtained the number of pullets he would like. The average production of one's flock is what counts, and it is much wiser to aim for a medium-sized flock of good birds than a larger number amongst which are many inferior specimens: quality and not quantity should be the policy.

If late-hatched chickens have to be reared, extra care should be taken to see that such stock are raised on fresh, sweet ground away from where adult birds have been running. Brooder chickens will require careful watching from now on, and special care should be taken to guard against over-crowding. A canopy brooder in the early part of the season, and when the chickens are first hatched, may accommodate from 300 to 400, but when such chickens are three weeks old less than half that number is quite sufficient under the same hover. Cleanliness is essential at all times, but after brooder chickens are three weeks old, it is a

good plan to place some fresh litter under the hover each night. If the chickens are watched closely just as they are camping for the night to see that they do not crowd in heaps, and plenty of clean dry bedding material is provided, much trouble and loss may be avoided. As the chickens grow, it is well to see that more ventilation is provided at night, and in fact once they have settled down for the night very little artificial heat is required after the chickens are three weeks old. It is not to be inferred, however, that no artificial heat is needed, but if poultry-keepers who notice their chickens going off after they are about three weeks old would take the temperature under the hover, or in the brooder after the chickens have camped for the night, they might find the reason for the chickens not doing so well.

Feeding Chickens.

Many different and successful methods of feeding chickens are in use, and most poultry-keepers have their own systems. The following has given good results. The first feed when the chickens are about thirty-six hours old may consist of a good grain mixture (chick size), finely broken wheat, or three-parts finely broken wheat and one part of finely broken maize. It is a good plan to pour some whole milk on the quantity required about an hour before feeding-time in order to soften the grains, and any of these may be given four times a day for the first two feeding-days. A little finely ground oyster-shell should also be given. From two days until about nine weeks old, four feeds a day may be given, the first and last feeds being a grain mixture made up of three parts cracked wheat, one part shelled oats, and one part cracked maize, and the size of the grain may be increased as the birds grow. The other two feeds may consist of a mash made up of three parts pollard, two parts bran, one part finely cut succulent green feed, and 5 per cent. of bone-meal, the lot to be mixed with skim-milk, but if no skim-milk is to be had it is well to add about 7 per cent. of butter-milk powder or from 3 per cent. to 5 per cent. of meat-meal.

Green feed is a very important item, and in addition to that given in the mash a supply should be given each day after the chickens are three days old, but care should be taken to see that whatever is fed is succulent and tender.

Milk is one of the best feeds for chickens, and, if possible, should be given from the second day. After the first week sour skim-milk will be quite suitable as a drink, but it is not advisable to give it sour one day and fresh the next. Allow the chickens plenty of space at feeding-times, as crowding at feeding-times often starts toe-pecking. Many large poultry-keepers feed their mashes on sacks.

Hatching Duck Eggs.

Duck eggs generally lose vitality and fertility sooner than hen eggs, and therefore they should be set as fresh as possible and not older than seven or eight days They require a slightly lower temperature within the machine than hen eggs, especially during the first ten days, and a temperature of 102° during that period, 103° from that on, and 103½° to 104° (not higher) whilst the ducklings are hatching should give good results. Duck eggs require a little less ventilation than hen eggs to start with, but when the eggs start to chip, which is usually about the twenty-fifth day, they require more ventilation than is generally given when hatching hen eggs.

During the last ten days it is advisable to spray duck eggs with warm water (about 103°), and this may be done with the mouth or a small brush, once each day. Do not cool after spraying, but spray in the morning and put the eggs straight back into the machine and cool at night.

Export of Eggs.

During last season some 11,527 cases (345,600 dozen) of eggs were shipped to the United Kingdom, and exporters hope to increase that number by

about 25 per cent during the current season. Though the prospects of building up a large profitable egg-export trade are not very encouraging at the present time, all poultry-keepers realize how essential it is to unload the spring surplus on the overseas markets in order to maintain local values. There are some producers who have not done their share regarding export, and this is a matter that has caused and still is causing a good deal of dissatisfaction amongst those who have always supported export in a practical way, and have at times received less than those who have sold all their eggs on the local market during the export season. In their own interests producers should see that eggs are sent to market in the best possible condition.

The three most desirable qualities in a good marketable egg are freshness, cleanliness, and flavour. Eggs should be marketed at least once a week, and if possible more often, especially during the hot weather, as they deteriorate quickly if exposed to warm temperatures, and their food value is soon destroyed, especially if fertile. When fertile eggs are exposed to a certain temperature, whether it be in a hot kitchen, under a hen, or on a railway-platform the embryo starts to develop, with the result that the flavour is soon spoiled.

During the grading and packing of eggs for export during the past ten years, more eggs have had to be rejected on account of the shells being more or less soiled than for any other cause. If eggs were collected twice a day during wet weather and plenty of clean nesting material provided for the birds much of this trouble would be avoided When eggs are so soiled that they need washing it is a good plan to wash them in warm water as soon as they have been collected and before the animal heat leaves the eggs, as they are much less trouble to clean than when left till after they get thoroughly cold

A large number of eggs were rejected on account of being slightly cracked. Perhaps a little more care exercised when collecting and packing for market would help to reduce this loss A fair number had to be rejected on account of being a bad shape or too small This fault is really a matter of breeding, and if only those eggs of a good size, shape, and texture of shell were used for hatching purposes a good deal of this trouble would be corrected.

Eggs having tremulous air-cells and watery whites have to be rejected Much investigational work has been carried out by this Department and in other countries in an endeavour to ascertain the cause or causes of this defect. The result of tests carried out points to the fact that the method of packing for transport has considerable influence on the internal condition of many eggs, and if they are packed with the large end down tremulous air-cells and watery whites are likely to be produced. Also if eggs are allowed to get into a sweated condition the same defect is likely to result.

If all poultry-keepers would see that eggs are gathered regularly, marketed clean, at least once a week, in clean dry fillers and cases, and packed with the large end up, not only would the local market (which is the poultry-keepers' best market) be improved, but a larger percentage of eggs sent to the export floors would be shipped overseas.

—*C J C Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Attention to Feeding where necessary.

As advised last month, advantage should be taken of the milder weather conditions obtaining to complete the spring overhaul. This work should not be delayed, as broken weather which may be experienced not only delays operations but prevents the bees from gathering sufficient nectar to meet the requirements of the colony with its increasing number of young bees and larvæ to feed. The first examination is of the utmost importance, as it may reveal either cases where the stores are insufficient for the immediate requirements of the colony or cases of queenlessness.

The spring months are most critical for the bees, and the beekeeper will find that if adequate stores are not provided his losses from starvation will be as great as if not greater than those which result from inattention to disease. Few but experienced beekeepers, and those who suffer financially, realize how readily the supply of stores may become exhausted after breeding is in full swing in spring. Usually willows and other spring forage afford a good supply of nectar, but too often these sources of supply are cut off owing to the unsettled weather which invariably obtains in the spring. Normally where colonies contain good queens breeding will go ahead rapidly, as the colonies comprise a larger number of bees and larvæ the drain on the stores is enormous, and if left without food during a week's bad weather the colony will perish.

Reference to feeding at this period would not be necessary if careful consideration had been given to the matter at the proper time when placing the hives in winter quarters. It is in the autumn that the foundation of the next season's crop is laid, and this point is too often overlooked. Feeding to obviate starvation may be necessary, but it should be considered only as an emergency measure, and not one of general apiary practice. Too often beekeepers when taking the surplus pay little or no attention to the future requirements of the colonies in the way of stores, and in the process ultimately lose many that would otherwise yield a surplus.

Should feeding be necessary, a syrup comprised of one-third sugar and two-thirds water may be used. Use only the best white sugar. Once feeding is started it should be continued until such time as the bees can gather sufficient from natural sources.

Swarming.

In the warmer parts of the Dominion, and where colonies are up to normal strength, swarms may be expected any time in October Many beekeepers attribute swarming to overcrowded brood chambers, lack of ventilation, and poor queens; but it often happens that swarms issue when none of these conditions is present On the other hand, bees will refuse to swarm when everything is apparently conducive to their doing so It must be left to the beekeeper to decide whether he will increase his stock by natural swarming or artificially. If the former plan is adopted it will be wise to allow only strong colonies to swarm If a weak hive is showing symptoms of swarming, that is, if the bees are building numbers of queen-cells, these should be removed and the colony prevented from swarming until such time as it can be requeened A swarm from a weak hive is not worth encouraging, because it consists simply of a poor queen, probably failing, and a small cluster of bees.

If, however, a strong colony has made up its mind to swarm, the best thing to do is to allow it to throw a prime swarm, and then to guard most rigorously against after-swarming. This can best be done by cutting out all the queen-cells save one after the prime swarm has issued. Even then it is wise to watch carefully the parent hive for about ten days after the departure of the prime swarm, because there will be eggs in the old hive, and the bees may continue to raise queen-cells.

Prevention of Swarming.

Frequent examinations of the colonies—every week or ten days during the swarming season—for the purpose of cutting out queen-cells is a help; but this requires considerable work, and, since it frequently fails in spite of every care, it is not usually relied on.

The occurrence of swarming is largely due to overcrowded brood-chambers; hence the queen should be given plenty of room to lay. A suitable plan is to give a new brood-chamber comprising two drawn combs and the rest frames of foundation. It is advisable to secure the queen and confine her in this new chamber below a queen-excluder, placing the old brood-nests directly above, thus giving additional work for the young bees

and plenty of room in which the queen may lay. If for some reason this plan is not desirable, the brood may be equalized by robbing the stronger colonies for the benefit of the weaker.

A young queen in the hive is an outstanding factor of success, as bees are rarely inclined to swarm with a young queen if they have reared her themselves under natural conditions. This feature, however, is not always satisfactory to the beekeeper, as he frequently buys young queens in large numbers from a queen-breeder. He still has to contend against the swarming impulse, although in a lesser degree. A beekeeper rearing his own stock should select not only prolific queens from which to produce, but those that previously have shown the least tendency to swarm. There are also other reasons why young queens should be employed, and the practice of introducing them in the spring before the swarming-season commences, at intervals of not longer than two years, is an excellent one. Autumn introduction is also commendable, as the full tide of a queen's maturity is gained from the commencement of the following spring. In order to follow the lives of the mothers as closely as possible and to avoid mistakes some system of recording the various ages must be employed. In addition, notes should be taken of their general behaviour, such as tendency to swarm prolificness, and gentleness. Such notes will prove of great value in selecting a mother of future queens.

Ventilation also plays an important part in controlling the natural inclination to swarm, and care should be taken to provide sufficient air at all times of the season A well-known and effective method is to place blocks 1 in. high under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest. This forms two additional entrances and permits the workers to escape to the field without having to traverse the whole depth of the hive.

No single system will be found universally effective. Climatic conditions also frequently play an important part in the behaviour of bees. It will be found, however, that the methods here given, or variations of them, employed either singly or in combination materially assist in the prevention of swarming.

Prevention of After-swarming.

In many cases a prime or first swarm is desirable, and in others the bees often issue in spite of all precautions. It is a simple matter to hive the swarm, but to combat the results in the parent colony arising from this condition entails special action. Persistent after-swarming is one of the discouraging features of natural increase, and is often hard to stop. A good plan is to place the swarm on the old location, removing the parent colony to a new stand some distance away. The immediate result is for all the flying bees to join the swarm, and thus the parent colony is still further weakened. This encourages them to tear down all queen-cells but one, or to destroy all embryo queens after the first young queen has emerged from her cell.

Treatment of Swarms : Providing Supers.

There is little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established, these colonies will often swarm again and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are lost yearly through neglect to give ample room for the swarm to store honey. A few days after a swarm has been established a hurried examination should be made to note progress, and from this the beekeeper should be able to form some idea as to the time at which the super is likely to be required.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

THINNING and cultivating growing crops now requires attention ; unsatisfactory crops are commonly due to the neglect or delay in the performance of these operations, and a great amount of tedious labour then produces but a moderate result. If the precaution is taken to sow the seeds thinly after giving the land early preparation which will enable it to be cleaned by germinating and destroying weed-seeds near the surface, the task is greatly simplified and a considerable economy secured. Carrots, lettuce, radish, cabbage, and cauliflower seeds are commonly sown much too thickly, which causes a serious loss in seeds and labour. After cleaning the ground in preparation for sowing, it is important to avoid digging the land or cultivating deeply before sowing is done and bringing more weed seeds near the surface.

During the month of October late crops, such as intermediate carrots, long beet, salsify, potatoes, peas, broccoli, cauliflower, savoy, red cabbage, kale, and celery are sown ; also such half-hardy crops as dwarf and tall French beans, marrows, pumpkins, water and rock melons, and cucumbers.

In warm districts where a crop of globe beet and short-horn carrots may be sown in the autumn the supply of these roots is well maintained. In cooler districts where this practice is unsatisfactory crops of long beet and intermediate carrot sown now ensure a good supply in winter. Beet and salsify may generally be allowed to remain in the ground and dug as required, but the intermediate carrots will need to be lifted when mature—about the month of April—to avoid deterioration, which chiefly takes the form of splitting vertically.

In humid districts, especially if rather warm, the late potato crop runs serious risk from late blight, and Bordeaux or Burgundy sprays are needed to protect them from this attack. If fertilizers are required, and in the absence of any well-established local practice, a mixture of 3 parts of superphosphate to 1 part of sulphate of ammonia may be tried at the rate of about 5 cwt. per acre, distributing it in close proximity to the tubers when planting, which is preferable to broadcasting it for this crop. This rate works out approximately to 4 lb. of fertilizer to one hundred plants.

To maintain a varied supply of vegetables in winter, broccoli, cauliflower, kale, savoy, red cabbage, and celery are sown in beds during the month of October to raise plants for setting out early in the New Year, sometimes rather earlier, usually in ground left vacant by the removal of early crops such as peas, potatoes, &c. Broccoli and kale are very suitable for the colder districts Young plants of the cabbage family must be protected from the attack of diamond-back moth and aphis, as serious damage is done when infected plants are set out ; treatment then is also more expensive than when the young plants are together in the seed-bed A suitable spray is composed of 2 oz. arsenate of lead paste (or 1 oz. powder), 3 teaspoonfuls nicotine sulphate, and 4 gallons of water. Dissolve and dilute each ingredient before mixing, and apply it at intervals of about fourteen days as required.

One of the commonest diseases attacking celery is leaf-spot, caused by a fungus known as *Septoria apii* A good product can be produced only where this is kept well under control. Control should be commenced when the plants are in the seed-beds by spraying at intervals of about three weeks with Bordeaux mixture 3-4-50—that is, 3 lb bluestone, 4 lb hydrated lime, and 50 gallons of water. Early attention to the trouble is essential to success.

Green French beans, small marrows, melons, and cucumbers are desirable vegetables during the summer months, while dried beans and pumpkins are useful to add variety to the winter supply. In warm districts these

crops may be sown early in the month of October—in cooler localities towards the end of the month. For an early supply of melons and cucumbers, plants are sometimes raised under glass for planting out so soon as temperatures permit It is then necessary to carefully harden them off before planting and to nurse them until they become established and conditions are safe. In a light rich alluvial soil that is well sheltered and drained these crops reach their highest development. Sweet corn is another half-hardy crop which thrives under such conditions.

Salad crops may be sown now to meet the popular demand during summer; likewise spinach, which, being less susceptible to pests is an excellent substitute for cabbage at that season of the year. In dry districts especially, silver beet and New Zealand spinach should now be planted out, as they withstand dry conditions without the quality being impaired. The latter crop appears to be most successful when the seeds are planted in autumn so soon as ripe. In a sheltered spot outside they stand the winter well, and good plants are available with little trouble for planting out.

Land from which a crop of spring cabbage or lettuce has been cleared will be in good condition for planting tomatoes after it has been ploughed and cultivated when sufficiently dry and a dressing of bonedust, superphosphate, and sulphate of potash has been drilled in along the lines where planting is to be done. To obtain a good crop the plants should be clean, sturdy, and of a good strain. A fortnight to three weeks in the cradles to harden off is a necessary preparation, and an application of Bordeaux is generally advisable before removal. Soft, rank plants and stale plants are to be avoided, as the best results to be obtained from them is a poor late crop. The demand for the fruits of egg-plants and peppers is increasing, and probably will continue to do so as the knowledge and experience in cooking and serving increases These plants are rather more tender than the tomato, and planting out should be delayed until the weather is more settled. They are very suitable crops for the warmer districts

Where tomatoes are grown under glass the leaf-mould disease caused by the fungus *Cladosporium fulvum* very commonly makes its appearance at this season, especially where houses have not been thoroughly fumigated before planting and high temperatures with a close atmosphere are allowed to develop at the present time Ventilation is a most important operation in the successful production of this crop: more ventilation is now required at night, and this should be increased in the morning before the sun strikes the house In warm districts a generous provision of ventilators is necessary to do this effectively

Virus diseases have drawn a heavy toll from this crop during recent years, both under glass and outside As infection is due largely to the feeding of sucking insects, the crop under glass should have an advantage in that these pests may there be readily destroyed by fumigation They are frequently overlooked because they may be present in comparatively small numbers and the direct damage done is insignificant: it is necessary to realize that even under such circumstances the spread of virus disease by their means may be serious. These diseases may also be spread by the attendants by means of the hands or knife when pruning. Where infected plants are pulled and burnt it should be done carefully, and the operator afterwards should thoroughly wash his hands with soap. The host-range of many diseases of this class is fairly restricted; some are confined to the natural order known as *Solanaceae*, which includes tomatoes, tobacco, and potatoes, also the weed known as nightshade, which is common but which should be steadily suppressed. It is rather disturbing to hear from the Cheshunt Research Station that a number of brands of smoking-tobacco were tested and virus-disease infection was obtained from most of them: it is evidently a source of infection of very real danger where susceptible crops are grown The virus disease known as bronze-top or spotted wilt presents special difficulties owing to its very wide host-range, which includes a strange assortment of unrelated plants, which gives the impression that the list

could be considerably added to if time could be taken to make further trial inoculations. As the natural spread of these diseases is by means of insects, dry, warm localities and seasons are conditions under which the danger is greatly increased.

Salt is a traditional dressing for asparagus crops during the spring, although it has been proved to be not so generally important as was supposed : still in some localities it increases the crop, and the question has been raised as to the quantity that should be applied. There are records of so much as 2 lb. per square yard being applied with advantage after growth has commenced. In another case application of ½ lb. to the square yard failed to keep the weeds down—a secondary result that is commonly expected. In another instance an increase of 13·5 per cent. in a crop was obtained by applying 4 oz. to the square yard. In the absence of local data it would be advisable to try 2 oz. per square yard when growth commences in the spring, repeating it two or three times at intervals of about three weeks.

Small-fruit Crops.

Well-hardened-off plants of the tree tomato, *Cyphomandra betacea*, may now be planted out in warm districts in good land that is well sheltered. This comparatively short-lived semi-shrub belongs to the plant order *Solanaceae*, and is a native of Brazil Good plants are raised from the seeds of selected fruits, and they may now be set out 3 ft. apart and from 6 ft to 9 ft. between the rows. The fruit, ripening in the middle of winter when there is less variety than usual, is in fairly good demand, and as a cooked dish it has aroused some enthusiasm If the conditions are right it requires little attention Exposure to hard frosts and high winds are the commoner causes of any losses that may take place ; they destroy the large flaccid leaves

Rather more hardy, but requiring similar conditions, are the Cape gooseberry and passion-fruit Cape gooseberry is another member of the order *Solanaceae* from South America , but, being largely distributed from the Cape of Good Hope, it has retained a portion of that name It extends the berry season into the winter by producing excellent culinary fruits. Plants are raised from the seeds of selected fruits sown on a hotbed in early spring or a cold frame in the autumn—the latter for preference, as bigger plants are then available for setting out 3 ft apart and 6 ft. between the rows ; the rows may be closer if the plants are supported instead of being allowed to lie on the ground It can usually be cropped for two or three seasons before replanting is necessary.

Two or three kinds of edible passion-fruit are grown, but that known as *Passiflora edulis* is easily the favourite here It has a comparatively hard skin of a purple colour, and is said to be a native of the West Indies It also is raised from the seed of selected fruits, sown in autumn or spring, and the plants set out at the present time 9 ft. or 10 ft. apart, and the same distance between rows. Cropping commences the second year after planting and continues, under good conditions, for six or seven years, which is about the average life of the plant Unless the seed is sown where the plant is to grow to maturity, it is best sown in boxes and the plants grown on in pots for planting out, as it is otherwise rather difficult to transplant.

The present time is also most suitable for planting out loganberries, which require similar conditions to the others mentioned, and may be spaced like passion-vines, but rather more closely Both of these crops require a wire trellis for training the plants. The small fruiting plants mentioned above are of interest as being suitable for warm districts in which gooseberries, currants, and raspberries give unsatisfactory results.

It is also appropriate to mention here the progress made by growers in the production of rock melons in such localities on moist well-drained alluvial land. The small fruit of high quality that is sometimes grown is delicious summer fruit, carries well, and is in good demand. Varieties of the Cassaba class are good keepers and suitable for the drier districts.

W. C. Hyde, Horticulturist, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FOOT-TROUBLES IN SHEEP.

M. R. H., Eketahuna :—

Owing to the prolific autumn growth, a large number of lame sheep are suffering from scald. Bluestone, 5 per cent. foot-bath, does not seem to have made any improvement.

The Live-stock Division :—

The treatment of scald in sheep does not call for strong solutions by way of foot-baths. It generally is considered that scald is the precursor to foot-rot, but one must distinguish between the two. Although a 5-per-cent. solution of bluestone is recommended for the treatment of foot-rot, one cannot recommend more than a 1-per-cent solution in the case of scald in sheep As the same conditions predispose to both diseases, it is always advisable to examine the affected sheep thoroughly in regard to the trimming of the foot. All loose overgrown or diseased horn must be trimmed thoroughly and removed A 1-per-cent. solution of bluestone should then prove effective as an astringent in the case of scald, and the stronger solutions should be reserved for foot-rot cases and cases showing the presence of the growth of proud flesh. It is advisable to remove the sheep to the best-drained paddocks while the treatment is being carried out.

SEEDLESS BARBERRY IN SOUTHLAND.

A. H., Kauana, Southland :—

What is the best cattle-proof hedge to plant in this locality ? Would seedless barberry grow here. The land is fair to heavy river flat.

The Horticulture Division :—

Seedless barberry has been grown as a farm hedge chiefly in the North Island, and there is little available knowledge about its behaviour for such a purpose in a southern climate It would be best to plant it experimentally at first Fair to heavy river flat should suit it well if the drainage is good. With macrocarpa shelter-belts to break the prevailing wind, it would possibly make a good combination

MORTALITY IN GEESE.

F. G. H., Mangapai :—

About eighty geese and ganders have a free range of pastures and paddocks and are not fed except what they get from the grass. They have developed a complaint that is proving fatal to some. The symptoms are—Neck swells up at base of throat; when they are hurried along they appear to get dizzy and fall over on their heads, and eventually rest on their breasts, linger, and die.

The Live-stock Division :—

Without examining the birds it is impossible to say just what the trouble is, but the symptoms you mention suggest that some of your geese are suffering from enlargement of the heart, or from dropsy of the heart-sac. Examination of a dead bird would, in the latter case, show the heart-sac full of liquid, and in the former the heart would be much enlarged. There is little known about the cause of these troubles, and, as diseases of the heart are usually not recognized while the birds are alive, treatment is not possible. With geese or ducks, especially old birds or those in too fat a condition, any excitement or over-exertion which causes an increase in the heart-beat and an increased blood pressure may result in a rupture of one of the large blood-vessels. It is well to drive geese quietly, and not to hurry or excite them too much.

WEATHER RECORDS: AUGUST, 1935.

Dominion Meteorological Office.

NOTES FOR AUGUST.

AUGUST was subject to the effects of several intense storm areas, and unsettled, squally conditions were frequently experienced; but there were various individual days as well as three more prolonged intervals when fine and mild weather prevailed. The generally fine spells covered the periods from the 1st to the 4th, 8th to the 13th, and the 22nd to the 28th, although in the latter period western areas had occasional showers. The month was remarkable for the early advent of strong westerly winds, and on this account the finest and mildest weather was experienced in districts east of the main ranges. There was little growth of pasture in parts of the east coast districts on account of the unusual dryness, but over most of the Dominion feed is plentiful and stocks have generally fared very well through the winter. On the other hand, the constant wet weather during the middle of the month in the Wairarapa and other parts of the North Island was detrimental to lambing. Fortunately, however, there were no unduly protracted or severe cold spells and no serious losses are reported.

Temperature.—At a few places in the central portion of the North Island the mean temperature was very slightly below normal, but over the rest of the Dominion the normal was exceeded.

Rainfall.—The total rainfall was again considerably below the average in the east coast districts of the South Island, and it was below, but to a less extent, in the east coast areas of the North Island between East Cape and Cook Strait. Most of the remainder of the country had more than the average.

Pressure Systems.—The month opened with fine weather, which continued until the 4th under the influence of a slight anticyclone. On the latter day the front of an intense westerly depression moved on to the Dominion, and strong northerly winds set in and were accompanied by heavy rain in western districts during the night of the 4th, and on the 5th and 6th with thunderstorms in places. The rear of this storm crossed the Dominion during the night of the 6th, when a general change to cold southerly winds took place, and heavy snow fell in the National Park area. In the east coast districts of the South Island only light and scattered rain occurred with the southerly change, and by the morning of the 7th the weather had improved over the whole of the South Island, the improvement extending over the North Island on the 8th.

From the 8th to the 13th, while an intense anticyclone was situated over New Zealand, mild and pleasant conditions prevailed throughout the Dominion.

The next important disturbance, one of the westerly type, first appeared on the 13th, and until the 21st a series of intense waves connected with it continued to cross the Dominion. During this period strong and squally winds from some westerly quarter prevailed, accompanied by heavy rain at times in districts with a westerly aspect.

From the 22nd to the close of the month an anticyclone covered the Tasman Sea, with its centre over the northern portion, but pressure remained low to the south and east of New Zealand. Consequently, winds between westerly and south-westerly predominated, occasionally rising to gale force in places. Otago and Southland suffered some damage in a south-west gale on the 24th, the gale being accompanied by heavy rain and hail in places. On the whole, however, during the period referred to, although strong winds were experienced in most districts, what rain fell was of a showery and scattered nature only and confined chiefly to western areas, very little falling in districts with an easterly aspect, but on the 31st a boisterous south-westerly brought a few heavy showers to Canterbury and some light snow in places.

RAINFALL FOR AUGUST, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·32	17	1·60	5·12	45·66	38·76
Russell	4·20	17	0·99	4·70	70·02	37·30
Whangarei	5·60	18	1·01	6·31	62·78	45·10
Auckland	4·71	19	0·96	4·61	47·83	34·47
Hamilton	4·89	18	0·58	4·11	34·48	33·11
Rotorua	7·77	16	2·33	4·91	51·61	36·76
Kawhia	4·61	14	0·82	4·63	..	36·18
New Plymouth	8·20	22	1·30	5·49	56·99	40·41
Riversdale, Inglewood	10·82	17	1·96	8·89	84·35	67·60
Whangamomona	8·27	12	1·47	6·02	62·23	48·99
Hawera	4·58	16	0·79	4·50	43·53	30·11
Tairua	6·61	18	1·08	5·84	57·64	45·71
Tauranga	4·71	17	0·97	4·30	46·52	36·12
Maraehako Station, Opotiki	4·18	14	0·76	5·49	53·24	37·73
Gisborne	2·10	11	0·51	4·33	33·35	34·29
Taupo	5·24	13	0·95	4·07	39·17	29·30
Napier	2·08	11	1·40	2·95	39·70	22·30
Hastings	2·06	11	1·62	3·13	20·91	23·42
Whakarara Station	2·83	10	0·45	..	48·51	..
Taihape	4·55	19	0·72	2·74	26·63	23·52
Masterton	4·36	17	1·28	3·59	28·66	26·54
Patea	5·48	14	1·14	3·81	40·86	29·44
Wanganui	4·67	12	1·31	2·81	30·37	23·85
Foxton	4·31	10	1·20	2·95	25·21	21·33
Wellington	3·42	10	0·73	3·93	24·89	29·67
South Island.						
Westport	10·02	25	1·84	7·70	63·98	62·50
Greymouth	10·16	23	1·58	7·48	70·06	64·97
Hokitika	9·53	24	1·41	9·24	81·01	73·29
Ross	14·69	18	3·48	10·43	84·22	82·38
Arthurs Pass	10·94	9	3·90	10·20	92·95	96·07
Okuru, South Westland	8·19	13	1·70	11·24	75·17	93·80
Collingwood	8·47	12	2·49	7·11	66·10	62·09
Nelson	6·60	12	2·58	3·06	33·73	24·86
Spring Creek, Blenheim	2·78	10	0·67	2·75	19·15	20·64
Seddon	2·05	8	0·95	1·90	12·83	16·62
Hanmer Springs	2·30	13	0·81	3·42	26·27	29·48
Highfield, Waiau	..	..	..	2·45	..	22·53
Gore Bay	1·26	7	0·56	2·64	15·04	21·31
Christchurch	1·22	8	0·38	1·82	13·94	16·99
Timaru	0·44	5	0·16	1·45	13·61	14·43
Lambrook Station, Fairlie	0·17	5	0·07	1·53	14·70	16·13
Benmore Station, Clearburn	1·43	10	1·17	1·48	15·48	16·02
Oamaru	0·82	9	0·26	1·74	13·40	14·44
Queenstown	1·92	13	0·99	2·05	22·12	19·43
Clyde	..	..	..	0·79	..	9·45
Dunedin	1·86	12	0·45	3·07	25·79	24·13
Wendon	1·46	12	0·25	2·05	24·59	19·27
Balclutha	2·22	13	0·80	1·78	23·30	16·27
Invercargill	3·08	25	0·35	3·20	36·04	29·78
Puysegur Point	7·95	27	0·89	6·94	60·86	55·35
Half-moon Bay	6·58	24	0·63	4·39	41·78	37·92

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LEMON-CULTURE.

W. K. DALLAS, Citriculturist.

FOR many years lemon-trees (*Citrus limonia* Osbeck) have been grown in various parts of New Zealand, but only during the last twenty years has planting been carried out on a commercial scale. Lemons can be produced profitably in the Dominion, and already their culture has developed into a useful industry. The production of lemons on an economic scale is confined mainly to restricted areas at Keri Keri, Whangarei, Auckland, Tauranga, and Gisborne, Hastings, and Nelson. In recent years the acreage under lemons in these districts has increased considerably. There were 86,204 lemon-trees in registered orchards throughout the Dominion on the 1st October, 1934, distributed in the respective districts as follows :—

Whangarei	..	15,356	Motueka	..	921
Tauranga	..	21,541	Christchurch	..	45
Palmerston North		1,188	Hamilton	..	1,085
Nelson	..	2,287	Hastings	..	3,456
Blenheim	..	300	Wellington	..	145
Auckland	..	36,185	Mapua	..	704
Gisborne	..	2,945	Dunedin	..	7
Masterton	..	39			

These figures do not include the lemons-trees grown in gardens throughout the country for private use.

It is unlikely that New Zealand will be able to develop an export trade in lemons as the world's markets are already supplied by countries more favourably situated. The local market is capable of absorbing larger supplies of good-quality lemons than it does at present, but the trees already planted may be capable of supplying this trade when they come into full bearing. In the circumstances, the further planting of lemons on anything like an extensive scale is a matter that should be approached with caution.

VARIETIES.

The main varieties grown in the Dominion for commercial purposes are the Lisbon and the Eureka. Other varieties which are grown to a limited extent are the Villa Franca, Sweet Rind (a strain of Eureka), and Genoa.

Lisbon.—Fruit of good quality, medium in size, oblong, of good even shape, and firm with a thin, smooth, pale-yellow rind, and with comparatively few seeds. The tree is a good cropper and produces much of its fruit in the interior of the tree. It bears two crops a year, the winter crop being the main crop. It has large thorns, which cause injury to the fruits coming in contact with them and makes pruning and picking operations more difficult.

Eureka.—Fruit of good quality, medium to large in size, oblong, of good, even shape, and firm with fairly thick, wrinkled, pale-yellow rind, and with comparatively few seeds. The tree is a moderate and consistent cropper and is thornless. It comes into bearing earlier than Lisbon. Fruit is largely borne near the tips of the branches and on young trees is inclined to be coarse.

Villa Franca.—Fruit of good quality, medium in size, oblong, slightly pointed at blossom end, of good, even shape, and firm with a thin, pale-yellow rind, and nearly seedless. The fruit from the young trees is inclined to be rough. The tree is a heavy summer bearer, a vigorous grower, and is practically thornless. The branches have shorter joints than other varieties, and on this account this variety is suited to somewhat exposed situations. The tree is of a spreading and somewhat drooping habit.

Eureka (Sweet Rind).—Similar in appearance and quality to Eureka, but produces fewer seeds, yields a greater quantity of summer fruits, and produces a smoother type of fruit than Eureka. It comes into bearing early.

Genoa.—Fruit of good quality, medium in size, oblong, of good shape, smooth, and attractive in appearance. The tree is a heavy summer cropper and bears heavily while very young. It has a drooping style of growth, with fine laterals and foliage, and is thornless. It is not so vigorous as some varieties, but this probably can be overcome by an annual moderate thinning of the young fruits until the trees are six years from planting.

STOCKS.

Since the commercial varieties of lemons grown on their own roots are susceptible to disease they usually are worked on to more resistant stocks.

It is very important that the stock should suit the conditions of the locality where the trees are to be planted. Many trees have died, while others have produced light and inferior crops, through the use of an unsuitable stock. The stock which is in most general use is the rough lemon known in Australia and New Zealand as "Citronelle," a horticultural variety of the lemon *Citrus limonia*. Other stocks which are in use to a limited extent are sweet orange (*Citrus sinensis*), sour orange (*Citrus aurantium*), trifoliate orange (*Poncirus trifoliata*), and the pomelo or grape fruit (*Citrus maxima*, var. *uvacarpa*).

The rough lemon, of which there are a number of strains, has been used extensively in a wide range of soils in all citrus-growing countries, but has the disadvantage of being sensitive to cold and susceptible to collar-rot, bark-blotch, gummosis, and citrus verrucosis in the heavier and wet soils. It is deep-rooting and has a well-developed root system,

which causes the trees worked on it, particularly those planted in light, sandy soils, to grow vigorously. In the early years of bearing the fruits produced are frequently poor in quality on account of the rapid growth of the trees, but after the advent of heavy bearing fruit of good quality is produced.

The sweet and sour orange stocks are more resistant to diseases than the rough-lemon stock. On the orange, the trees do not come into bearing as early as they do on the rough lemon, but remain productive for a longer period. Experience in other countries has demonstrated that the sweet-orange stock is suitable for light, deep, and well-drained soils and has a comparatively shallow-rooting system. It produces well-shaped trees. In this country stocks of this orange are usually raised from selected pips of the Cook Island sweet orange.

The sour, or Seville, stock is hardy and well supplied with deep-rooting roots and is adapted to most situations, but thrives particularly well on heavy soils.

The trifoliate orange is not recommended for commercial orchards, but may with advantage be used in domestic gardens where large trees are not desirable. It is a very hardy slow-growing stock with a dwarfing effect upon the scion. It forms a good deep-rooting system and is suited to localities with a rich heavy loam containing a fair amount of moisture. It is entirely unsuited to light, sandy soils.

Not a great deal is known of the performance of the Pomelo stock, but it is recorded that it is susceptible to collar-rot and gummosis in the heavier soils. It is also recorded that from a small and crooked tap-root a strong lateral root-system develops at a somewhat deeper level than the roots of the sweet orange.

Further experimental work remains to be done before definite recommendations can be made as to the stocks on which lemon varieties should be worked in this Dominion.

RAISING STOCKS AND TREES.

The practice in raising seedlings for stocks is to save fruits from selected trees which exhibit a strong healthy growth. The seed is removed from the fruits, and the largest are selected and are stratified in sand until the time for planting arrives. The time best suited for planting the seeds is from the latter part of September to the end of October. The seeds are set out in well-prepared soil in rows 9 in. apart and 2 in. to 3 in. apart in the row. The seeds are set in drills 2 in. deep and covered to the depth of 1 in. Until the seedings are well established the soil is kept moist and well cultivated.

The seed-bed is protected from the winds and the hot sun by covering it with scrim or other suitable material. The soil is not allowed to become baked.

By the autumn, if the plants make reasonable growth, they reach a height of from 8 in. to 12 in. In the following spring the strong plants are set out in nursery rows 3 ft. apart and from 12 in. to 15 in. apart in the rows. The weaker plants may be allowed to remain another year in the seedling-beds, but it is better practice to destroy them. Diseased plants should be discarded. In the year following the transplanting, when the sap is flowing freely, which is usually from November to March, budding is done in the same manner as on other classes of

trees. The buds should, however, be inserted at a point 8 in. to 12 in. above the soil-level so as to lessen the possibility of the wood of the scion becoming contaminated with bark-blotch, &c.

Citrus stocks should not be budded until the wood has reached suitable dimensions, whether this be two or three years from the time the pip is sown. A lead-pencil is often referred to for illustrating the size of stock wood desirable, but a stock of this size cannot be relied upon to produce the growth required. A ½ in. to ¾ in. orange stock and ½ in. rough-lemon stock will be found to give more general satisfaction than those of smaller diameter.

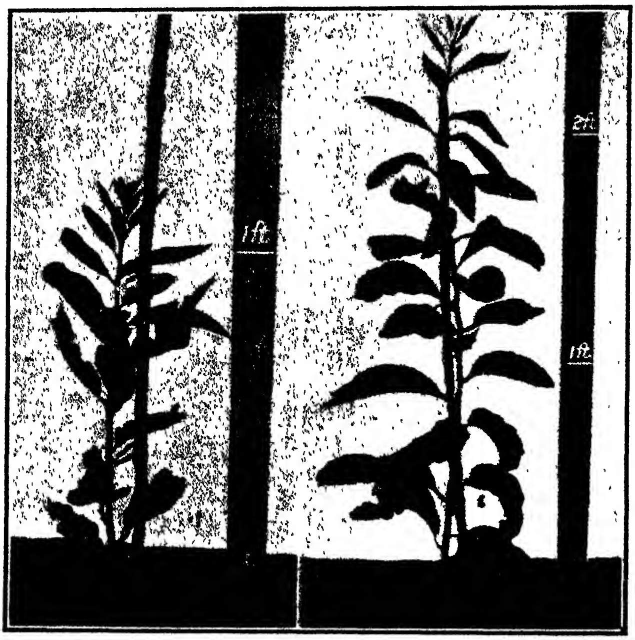

FIG. 1 THE EFFECT OF SIZE OF STOCK ON GROWTH OF THE SCION.

On left, Crisp's lemon on lime-stock of ¼ in. diameter, budded 15th March, 1920; growth made to 20th December about 15 in. On right, Crisp's lemon on lime-stock of ¾ in. diameter, budded on same date, but with about 30 in of strong growth to 20th December

The budwood should be selected from trees which are thrifty, heavy regular bearers, and producing fruit of approved type. On account of the bud-variations which occur on individual trees the fruit on the branches from which the budwood is taken should be carefully examined to ensure that it has the desired characteristics. The buds near the tip and near the base of the bud stick should not be used. The scions should be at least ¼ in. in diameter (about pencil thickness), rounded, and dark green in colour, with plump well-developed buds.

The months November and March, when the sap is flowing freely, are the best times to do the budding. When the buds are about to break in the following spring the stock should be cut back to within 8 in. above the bud. The wood left above the bud is used for tying the

young growth to, as this is better practice than tying it to stakes. In the following spring, after the danger from frost injury is over, the wood above the bud should be carefully removed with a sloping cut and a protective wound-covering applied.

The budded trees should remain in the nursery row for eighteen months to two years before being planted out in their permanent positions. Detailed information in reference to budding is given in Bulletin No. 81, " The Budding of Fruit-trees "

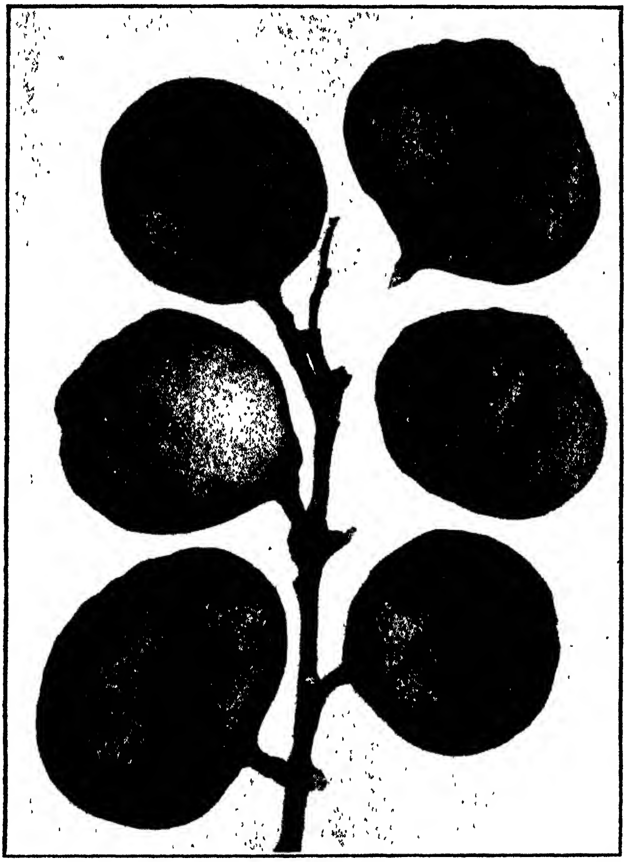

FIG. 2 OFF-TYPE EUREKA LEMON—TO BE AVOIDED WHEN SELECTING BUDWOOD

SELECTING THE YOUNG TREES.

In the establishment of a productive orchard success is largely dependent on the quality of the young trees.

Only thrifty well-rooted trees with well-coloured healthy bark should be selected. Weakly trees and those that have the lowest main branch less than 2 ft. from the ground-level should be rejected. Orders should be placed early with a reliable nurseryman, and no attempt made to obtain cheap lines. Maiden trees—one year from the bud—

should have one clean, straight stem from the point where budded. Two-year-old trees should have at least three strong thrifty branches. Trees that have been summer-pinched in the nursery to cause them to branch, and have made weak shoots, should be avoided.

Preliminary Treatment of the Trees.

Trees should be unpacked as soon as possible after their receipt from the nursery, and at once heeled-in. Heeling-in is done by opening up a shallow trench in which the trees are placed in a sloping position and at right angles to the line of the trench. Although the trees may be laid closely together they should be placed singly so that the soil comes in contact with all the roots. Then the roots should be covered with soil, which should be trodden moderately firm, and then more soil should be thrown on so as to leave a loose surface. The trees remain heeled-in until required for planting. Before heeling-in, all roots bruised in the process of lifting from the nursery should be cut back to above the injury, since any damaged roots left to die back are likely to seriously interfere with the formation of new roots.

Climate and Soil.

Among the essentials for the cultivation of citrus fruits are a comparatively warm climate, absence of extreme winter conditions, a fair rainfall without long periods of droughts, and good friable soil with a subsoil that will allow of deep rooting and perfect drainage. Lemons are grown on many types of soil, but that recommended is a deep sandy or clay loam over a porous subsoil. Since the trees are evergreen they are never dormant, so that the soil in winter should be well drained and warm to permit of continuous root-growth. On most stocks lemon-trees are not particularly deep-rooting, and therefore the subsoil should be of a nature that will encourage deeper rooting. This will assist the trees to better withstand drought conditions. The subsoil should be loose and either naturally well drained or capable of being thoroughly drained by artificial means. Shallow soils, heavy clay soils, swampy soils, or soils that have a hard-pan or an impervious clay subsoil are unsuitable for citrus-culture.

As lemon-trees are liable to injury by severe frosts areas in which they occur should be avoided. The best positions for orchards are the northerly slopes of low hills with easy grades or level land not locked in by hills. Areas exposed to winds or where fog lies heavily should not be selected. The rainfall in the citrus areas of the Dominion is usually sufficient to meet the needs of the trees.

Preparation of the Land.

No planting should be done until the whole area is properly prepared. It is a mistake to plant trees with the intention of making the necessary improvements afterwards, since in very few instances is it possible to do this thoroughly. Where there is scrub growing on the land it should be grubbed and burned. It is inadvisable to plough woody matter into the soil, as this material is liable to become a host for fungous diseases. If there is a sward of grass the first ploughing should be shallow—*e.g.*, skim-ploughing. The furrows should be broken down with disks and left for a few weeks. The land should be deeply cross-ploughed when the turf is dead, but if twitchy-grass plants are present

they should be grubbed and harrowed out before ploughing. The soil should be thoroughly worked and brought to a fine tilth. It is a good plan to devote two whole seasons to the preparation of the soil prior to planting. A crop of potatoes followed by lupins in the first season, followed by further working and cover crop in the following season, leaves the soil in suitable condition to receive the trees. Superphosphate 44–46 per cent. at the rate of 3 cwt. per acre, carbonate of lime 3 cwt. per acre, and sulphate of potash 1½ cwt. per acre should be sown with each cover-crop. The cultivation necessary for the potatoes breaks up the soil and suppresses weed-growth, while the lupins supply a good body of humus. Where practicable, the ploughing-in of the cover-crop should be delayed until fibre has developed in the plants, which would be at the commencement of the flowering-period

DRAINAGE.

Good drainage is essential to successful citrus-culture and must therefore be considered together with the preparation of the land. Such troubles as collar-rot, bark blotch, &c., are frequently caused by insufficient drainage. Most orchard areas require additional drainage. A drainage scheme should be capable of carrying away the water quickly when heavy rains are experienced The necessary drains should be laid down before the cultivation of the land is undertaken. The soil must be free from surplus water in the winter as well as in the summer. The water-level should be as low as possible. Good drainage greatly assists in the improvement of the fertility of the soil. Land which cannot be readily drained should not be selected for citrus planting, and where trees are planted on soil which cannot be readily drained it may be advisable to put the land to some other use.

SHELTER.

It is essential that the orchard should be adequately sheltered from all winds. Good, permanent shelter-belts around the boundary should be established at least two years before planting the orchard so that the lemon-trees may receive early protection. This shelter may consist of either *Cupressus lawsoniana* or *Cupressus macrocarpa*. *Pinus muricata*, *Pinus insignus*, and *Eucalyptus amygdalina* are also used by some orchardists.

Until the permanent shelter has reached a height to provide adequate protection it is advisable to subdivide the orchard into small blocks by planting out a quickly-growing temporary shelter such as *Albizzia lophantha*, which will give early results. This tree has proved very satisfactory, and from seed on suitable soils it makes rapid growth. The seed* should be sown ½ in. deep in the position where the trees are to grow. The use of such a shelter tree enables the lemon-trees to be planted out several years earlier than if planting had been delayed until protection was provided by the permanent shelter. This tree is, however, subject to borer, and therefore should not be allowed to

* The seed should be softened before sowing Place the seed in a bucket and cover it with water that is nearly boiling, leave the seed in the water for ten or twelve hours; then pour the contents of the bucket into a fine-meshed riddle; mix the seed with a little dry sand to separate it. Sow as soon as possible, the seed must not be allowed to dry after soaking.

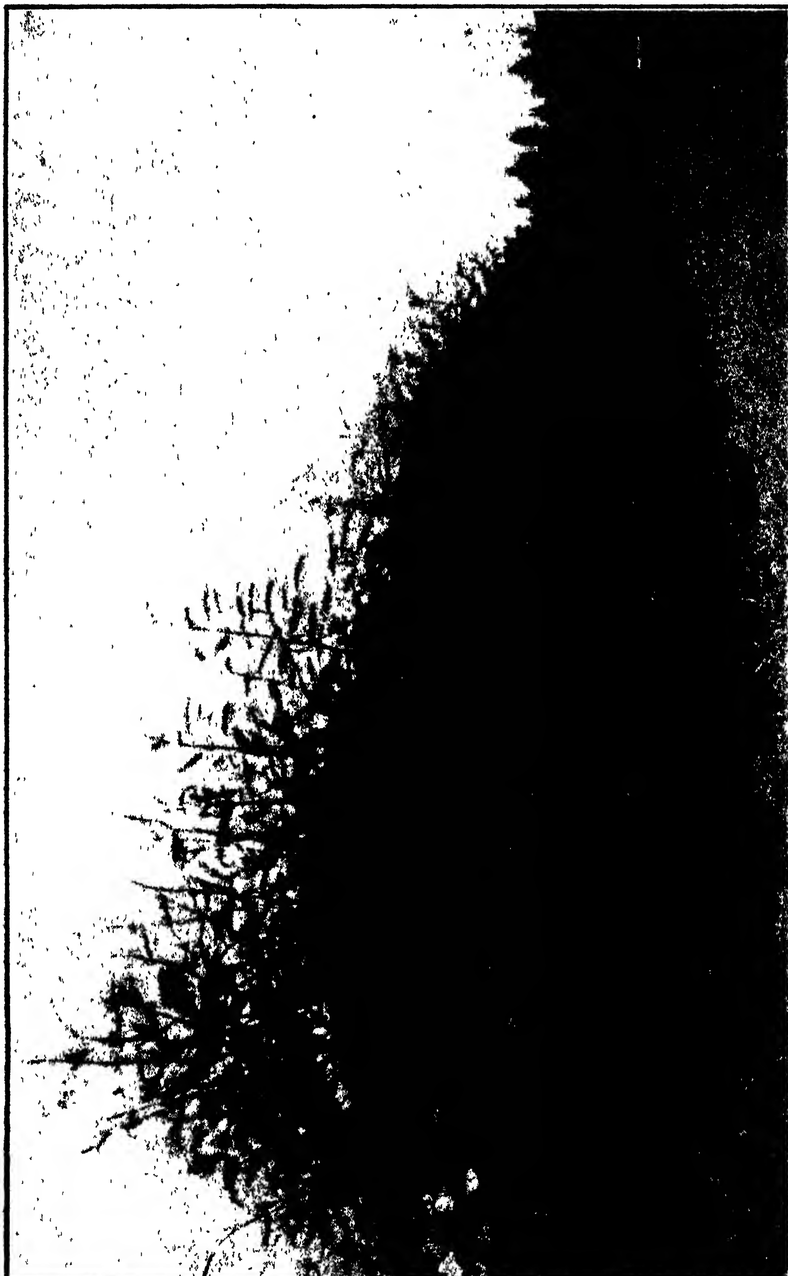

FIG. 3. ALBIZZIA LOPHANTHA EIGHTEEN MONTHS FROM SOWING OF SEED (AT KERI KERI).

remain after the permanent shelter has reached sufficient height to give protection to the orchard. Experience has shown that citrus trees respond to good shelter. Since young trees checked in growth by exposure for several seasons seldom make satisfactory growth afterwards it is far better to delay planting for a year or two rather than set out trees in exposed positions.

Before planting the shelter trees the land should be well worked and a good tilth maintained until the trees become so large as to make satisfactory cultivation impracticable.

(To be continued.)

SWEDE AND TURNIP VARIETIES.

THEIR DESCRIPTION AND DISTRIBUTION IN NEW ZEALAND.

J. W. HADFIELD and R. A. CALDER, Agronomy Section, Plant Research Station, Palmerston North.

(Continued.)

CRIMSON KING GROUP.

Varieties: Crimson King (Fig. 4*a*), Elephant (Fig. 4*b*), Monarch (Fig. 4*c*), Abundance (Fig. 4*d*).

Foliage medium green with bluish tinge, mid-rib and stalk reddish-purple. Skin colour a deep and somewhat glossy purple. Shape, tankard, with parallel sides. Flesh yellow.

Of the twenty-four samples sent in for trial two were wrongly named and five were somewhat mixed in type.

In all trials Crimson King (Fig. 4*a*), Elephant (Fig. 4*b*), and Monarch (Fig. 4*c*) appeared to be identical, and this fact was recorded as far back as 1918 by Mr. J. W. Deem, late Director of the Fields Division, who, when reporting on trials, described them as strains of the same variety. Most of the seed is sold under the name of either Crimson King or Elephant. The variety is regarded as early, stands well out of the ground, and gives satisfactory yields over a wide range of conditions It is most extensively grown in Southland under the name Elephant, but in the North Island is better known as Crimson King Very little is known of Abundance (Fig. 4*d*).

CHAMPION GROUP.

Varieties: Champion (Fig. 5*c*), John Bull, Skirving's Purple Top, Carter's Masterpiece.

Foliage has a bluish tinge and the mid-rib and stalks reddish-purple. Skin is smooth, colour a deep purple. Globe-shaped, almost spherical. Flesh yellow.

A few lines of John Bull were included in this group. Champion and Skirving's are grown to a limited extent only, and John Bull is of still less importance. Carter's Masterpiece has been placed tentatively in this group as a result of one year's trial.

BRONZE TOP GROUP.

Varieties : Hernings (Fig. 5*b*), Invicta, Halewood, Hurst's Bronze Top, Incomparable, Caledonian, Great Crop, Up-to-Date.

Foliage light to medium green, with sometimes a yellow and sometimes a blue tinge. Mid-rib and stalk light green, sometimes tinged

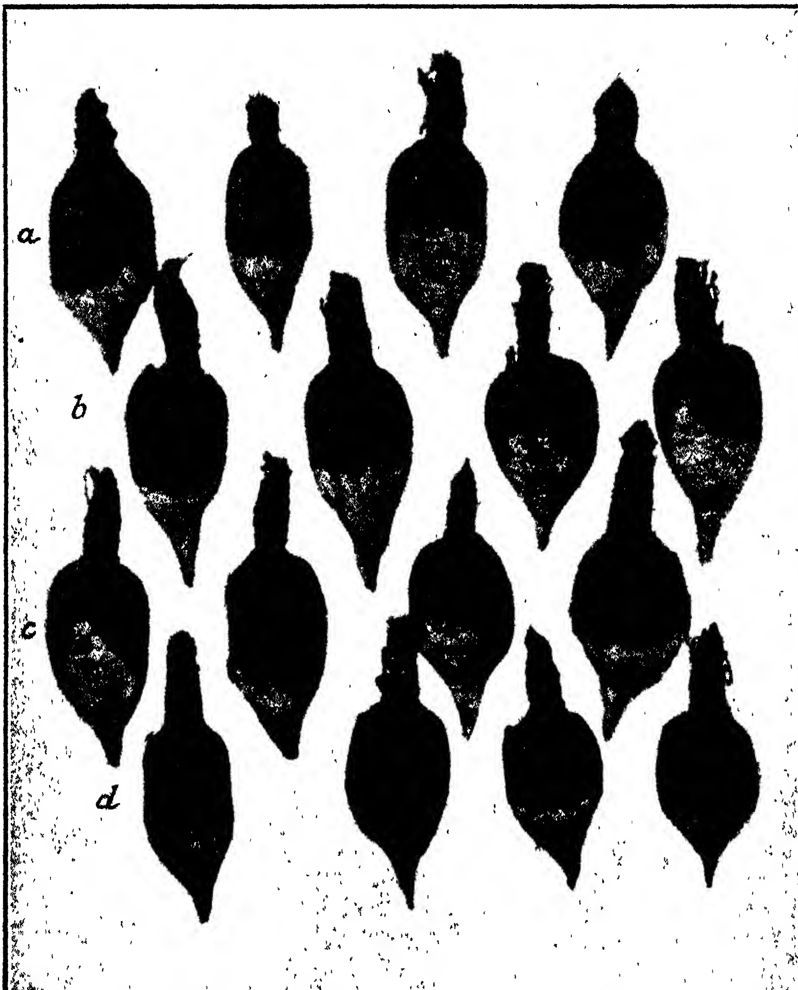

FIG. 4.

a Crimson King ; *b* Elephant ; *c* Monarch ; *d* Abundance.

No distinction could be found between these varieties.

with yellow. In Hernings stalks are occasionally tinged with reddish-purple. Shape generally oval, although Hernings and Up-to-Date are globe-shaped. Shoulders sloping or rounded. Colour a mixture of purple and green or bronze, Hernings varying from pure green to a dull purple, the dominant shade being a purple-bronze. Flesh yellow.

Bronze Tops are not extensively grown in New Zealand and represent but 5 per cent. of the total area. Hernings, which is the most important (Fig. 5*b*), was first introduced in 1927 as Bangholm Improved Purple Top, Hernings strain, and tested out at various places In more extensive trials conducted at the Gore Experimental Farm in 1928–29 and 1929–30 it proved to be exceedingly resistant to club-root, the yields appeared satisfactory, and the roots palatable. Its extension has been limited, however, owing to the fact that in a medium crop the roots are too deeply buried and the yields have proved irregular and often well below such varieties as those in the Superlative and Majestic group. Perhaps a still more serious check to its extension has been due to the importation of lines which proved on trial not to possess as satisfactory resistance to club-root as did the original importations. Finally, Hernings frequently has been reported to be more highly infected with dry-rot than other varieties, possibly due to susceptibility, but more probably to the seed being highly infected.

The several varieties placed in this group are by no means all similar. Up-to-Date is becoming increasingly popular, but of the others only odd crops are grown, and there is at present a tendency for Hernings to decline in popularity.

GREEN TOP GROUP

Varieties : Sutton's Green Top, Benefactor, Wilhelmsburger Otofte, Hurst's Conqueror

Foliage, mid-rib, and stalk of a medium green with yellow tinge. Globe-shaped, with rounded shoulders. Skin green. Flesh yellow.

Green Top varieties of swedes are even less popular in New Zealand than the Bronze Top, and, with the possible exception of Wilhelmsburger Otofte, only in certain localities do they appear to give satisfaction

Benefactor (Johnston's) is apparently identical with Wilhelmsburger Otofte The variety has exhibited marked resistance to club-root and is more consistent in this respect than Hernings. The first trials were reported from the Gore Experimental Farm in 1930–31, when it outyielded Hernings and proved to be more highly resistant to club-root. At this Station during the past season it has given a yield equal to Majestic and considerably in excess of Hernings. Officers of the Mycological Section of the Plant Research Station regard this variety as most promising, and are controlling the production of seed, free from dry-rot infection, from a strain of proved resistance to club-root.

WHITE FLESHED - PURPLE TOP GROUP.

Varieties : Vilmorin White Fleshed Purple Top (Fig. 5*a*), Sutton's Sensation.

Foliage dark purplish-green, mid-rib and stalk distinct purple. Shape, long tapering tankard, with deep tap-root often associated with pronounced fang-development. Skin colour a very deep purple. Flesh white and firm.

The two varieties of this group may be regarded as the same, but Sutton's Sensation is a superior selection in which fang-development has been reduced to a minimum.

The variety was originally introduced by Mr. J. W. Deem, late Director of the Fields Division, in 1919, and was tested out at the Stratford Demonstration Farm, where it proved to be less infected

with dry-rot than any other variety. In nine subsequent trials of which records are available it is stated to have been less infected with dry-rot, although recent observations by the Mycological Section do not support the suggestion that the variety is resistant. In nearly all trials it has given the highest yield. Thus in a series of ten trials in Canterbury in 1926–27 and 1927–28 it outyielded the control on every farm, giving an average increase of 6·1 tons per acre, and in the case of large roots showed a significant increase in dry matter of 11 per cent. over control. It may be said of this variety that it is hardier and gives heavier yields than any other and yet occupies only

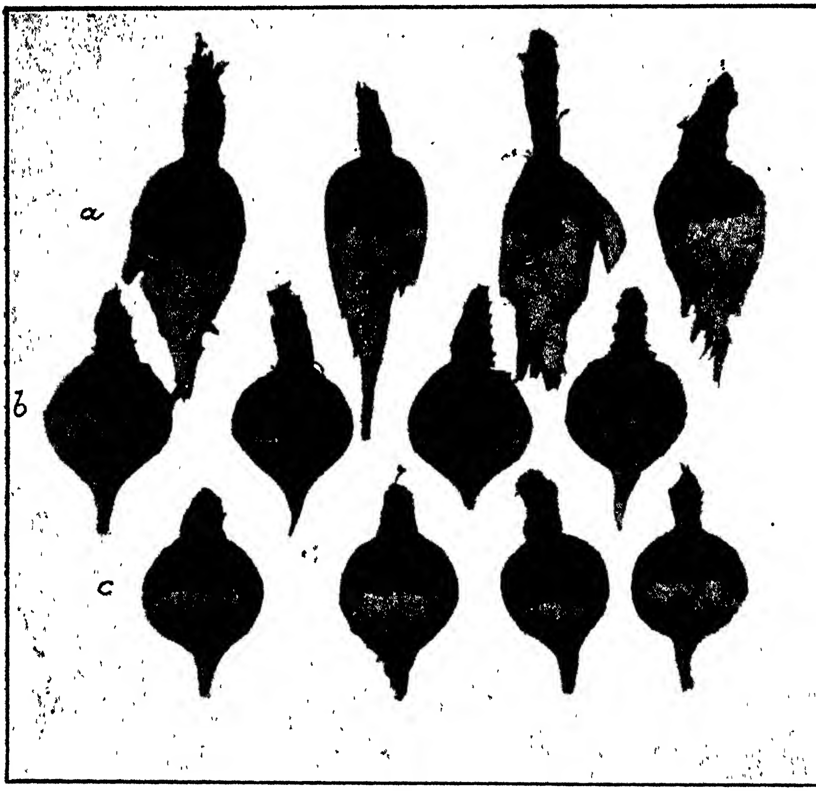

FIG. 5.
a White Fleshed Purple Top, *b* Hernings; *c* Champion.

1 per cent. of the area sown to swedes It has the disadvantage of being deep rooted and fangy, resulting in a certain proportion of loss when feeding. Despite this loss, however, it would probably still outyield other varieties. Furthermore, its popularity suffered a severe check when, at a critical period, a large consignment of seed incorrectly named was imported and widely distributed.

Distribution of Varieties.

The following table contains, as near as can be obtained, information regarding the popularity and distribution of swede varieties in New Zealand.

TABLE 2.—THE DISTRIBUTION OF SWEDE VARIETIES IN NEW ZEALAND, STATED AS THE ACREAGE IN EACH DISTRICT AND AS A PERCENTAGE OF THE AREA IN SWEDES IN EACH DISTRICT, WITH A SUMMARY FOR ALL NEW ZEALAND.

Area devoted to		Southland, Mid and South Otago.	Central and North Otago, South Canterbury.	Mid and North Canterbury	Marlborough and Nelson	Manawatu and Wanganui.	South and North Taranaki.	Wairarapa, Hawke's Bay, and Poverty Bay.	Waikato, King-country and Central Plateau.	North and South Auckland, Bay of Plenty.	All New Zealand.
All varieties	..	73,800	27,100	7,150	900	24,100	10,950	6,300	37,600	6,650	194,850
Crimson King ..	Percentage	*	4·7	2·7	3·0	18·1	5·4	2·6	19·2	12·9	7·8
	Acreage	..	1,269	197	27	4,380	576	165	7,232	862	15,281
Elephant ..	Percentage	26·0	6·0	2·7	.	.	..		.	2·6	11·0
	Acreage ..	19,100	1,624	197	.	.		.	..	176	21,410
Monarch ..	Percentage	*	..	*	.		*		*	8·6	1·2
	Acreage ..	..	..	..	.				.	574	2,249
Majestic ..	Percentage	2·0	10·9	.	3·3			3·6	4·4	*	3·9
	Acreage ..	1,550	2,940		30			231	1,760	..	7,509
Grandmaster	Percentage	7·6	13·0	*		*	14·1	2·1	1·4	*	6·9
	Acreage	5,620	3,560		.		1,542	132	1,760	.	13,536
Tipperary	Percentage	2·0	*	*	.	*	*	..		..	1·1
	Acreage	1,550	.		.		.	.		.	2,077
Superlative (Garton's)	Percentage	18·3	20·9	47·6	36·7	30·4	8·8	40·2	20·9	27·3	22·3
	Acreage .	13,540	5,674	3,550	330	7,230	966	2,535	7,856	1,820	43,451
Masterpiece (Webb's)	Percentage	19·0	8·3	12·4	*	10·0	9·1	9·7	14·2	3·9	13·9
	Acreage .	11,160	2,246	920		2,410	994	615	5,472	262	27,143
Success ..	Percentage	2·0	*	2·7		*	*	3·1	..	*	1·3
	Acreage .	1,550		198	.		..	198	..	..	2,440
Magnum Bonum	Percentage	*	*	*	*	*	5·8	5·9	1·8	*	1·9
	Acreage .	.	.	.			648	372	704	..	3,652
John Bull ..	Percentage	*		*			*	.	.	6·8	0·6
	Acreage ..	.	.	..		.	.		..	405	1,144
Superlative (Sutton's)	Percentage	6·8	18·6	14·9	22·0	20·0	36·4	20·5	18·7	24·8	14·9
	Acreage ..	4,990	5,054	1,095	198	4,820	3,990	1,296	6,048	1,651	29,082
Champion ..	Percentage	*	*	*	16·6		*	*	*	*	1·0
	Acreage ..	.	.		150	.		.	.		1,931
Masterpiece (Carter's)	Percentage	*	3·2	*		*	5·1	.	.	..	1·8
	Acreage .	..	980	.	..		562	..		.	3,447
Hernings ..	Percentage	3·7	2·8	5·3	6·6	10·8	*	5·4	*	2·8	4·3
	Acreage ..	2,700	735	395	60	2,630		315	..	186	8,322
Up-to-Date ..	Percentage	.	*	.			*	.	*	*	0·5
	Acreage .	.	.	.		.	.	..	..	.	924
Green Top (Sutton's)	Percentage	*	2·8	*	*	.	.	*	..		1·5
	Acreage .	.	735				..	.	..	.	2,865
White Fleshed Purple Top	Percentage	..	2·9	*	2·6	*	3·5	3·5	..	..	1·0
	Acreage ..	.	779		24	..	360	222	..	..	1,860

* Varieties so marked represent under 2 per cent. of the area of the district, allowance for which is made in the totals.

Yellow-fleshed Turnips.

Varieties may be grouped most conveniently as follows :—

Purple Top : Purple Top Yellow Aberdeen, Waite's Eclipse, Bruce, Favourite.

Green Top : Green Top Yellow Aberdeen, Fosterton Hybrid, Dale's Hybrid, Wallace, Golden Vale, Early Sheepfold, Perfection.

Green Top Netted : Romney Marsh, Centenary.

Yellow Top : Yellow Tankard.

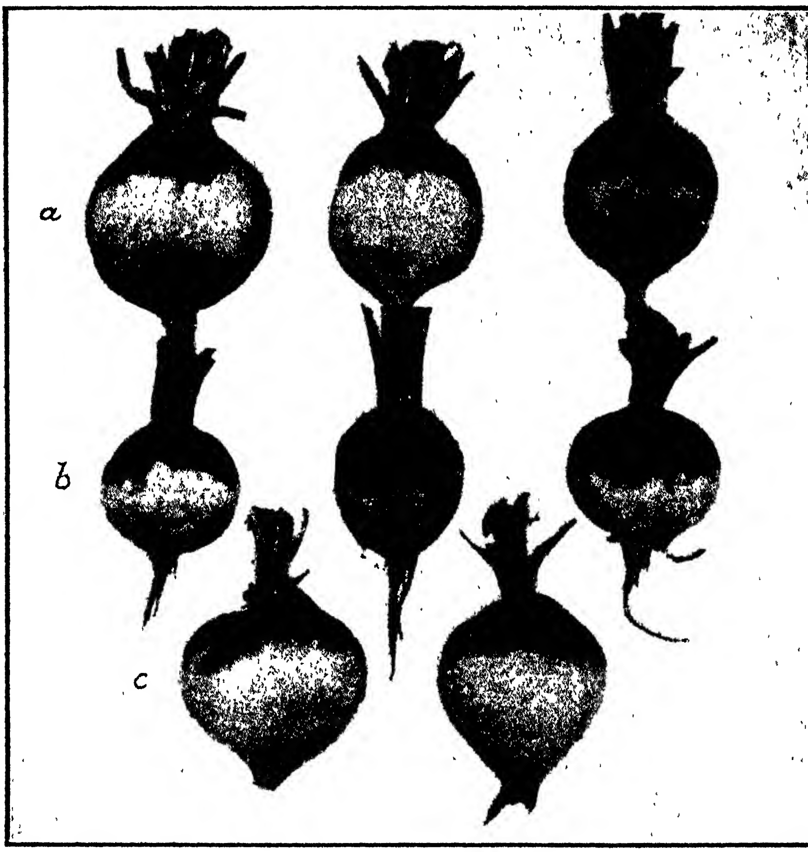

FIG 6

a Purple Top Yellow Aberdeen ; *b* Waite's Eclipse , *c* Favourite.

Yellow-fleshed turnips occupy only about 73,500 acres, or 17 per cent., of the total area devoted to swedes and turnips, and more than half of this acreage is in Southland and South Otago. The crop is somewhat exacting in its requirements, requiring a cool climate, and is quite unsuited to a large part of New Zealand. It would appear that the growing of yellow-fleshed turnips is steadily declining in all but the most favoured districts.

YELLOW FLESHED - PURPLE TOP GROUP.

Varieties: Purple Top Yellow Aberdeen (Fig. 6*a*), Waite's Eclipse (Fig. 6*b*), Bruce, Favourite (Fig. 6*c*).

Foliage green mottled with purple, stalk and mid-rib purplish, crown and shoulders rounded. Shape, globe. Favourite is rather more tapering. The colour is dark purple and is due to an association of red with green. The green can generally be seen as an uneven and variable band at ground-level or, if not apparent here, can be discerned

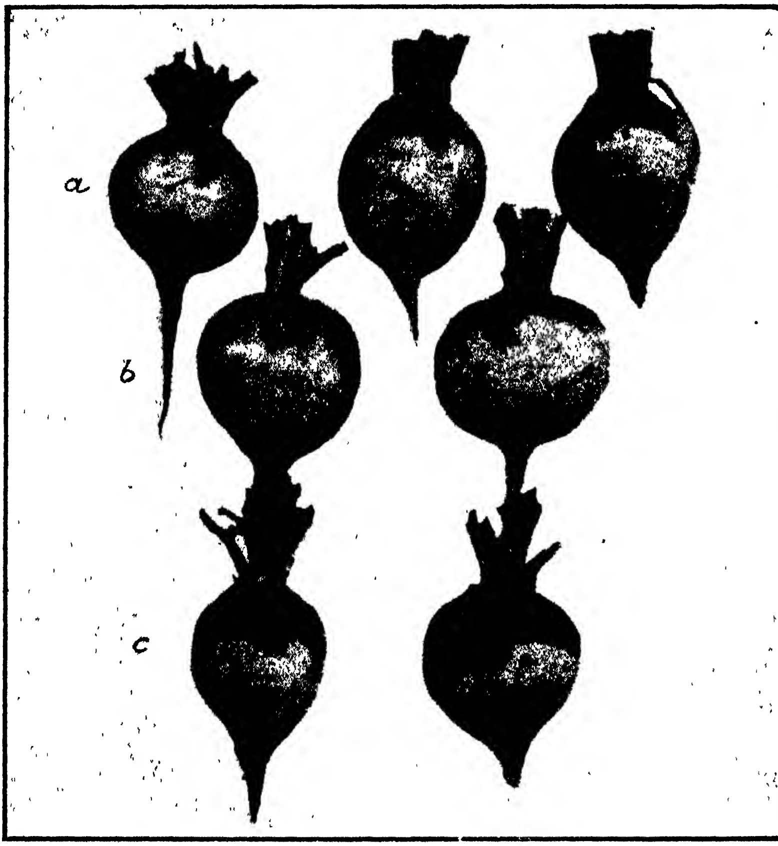

FIG. 7

a Green Top Yellow Aberdeen; *b* Fosterton Hybrid; *c* Dale's Hybrid

in the underlying tissue if a thin layer of outer skin be scraped away. The colour below ground-level varies from a creamy-yellow to red in all varieties except Favourite, where it tends to be a bright orange. Skin smooth. Flesh yellow, slightly mottled with white This group occupies over one-half of the area devoted to yellow-fleshed turnips.

Purple Top Aberdeen is generally considered earlier than Green Top Aberdeen. Under favourable conditions the yield and keeping-qualities are excellent. Purple Top Aberdeen, representing as it does about 35 per cent. of the area devoted to yellow-fleshed turnips, is by far

the most popular variety. Bruce is very definitely resistant to club-root. This variety and Wallace (Green Top) have been in cultivation in the North of Scotland for nearly a century, and were brought to notice by Mr. W. M. Findlay, of Aberdeen, and the North of Scotland Agricultural College. It was introduced to New Zealand by Mr. R. B. Tennent, Director of the Fields Division, in 1931, and first tested at Gore in 1931–32. Since then extensive trials have been carried out and numerous farmers have grown the variety with gratifying results and already it represents 5 per cent. of the yellow-fleshed turnips grown. Bruce, as originally imported, was a mixture of Purple Tops and Green Tops. The Purple Top variety now goes under the name "Bruce," and the Green Top under the name "Wallace." As far as is known, Bruce is equal in yielding-capacity to Purple Top Yellow Aberdeen, and, in addition, is resistant to club-root, which, in those parts where yellow-fleshed turnips are grown, is frequently the most important consideration. Some lines of Bruce imported into this country have proved susceptible to club-root, and either the strain has not been resistant or the seed has been mixed with or replaced by Purple Top Yellow Aberdeen, to which it is so similar as to defy differentiation. Several growers in Southland are now producing Bruce and Wallace seed under Government certification, which will be a distinct safeguard in this direction. It is almost certain that in future Bruce will be grown extensively on land in which club-root occurs.

YELLOW FLESHED-GREEN TOP GROUP.

Varieties: Green Top Yellow Aberdeen (Fig. 7*a*), Wallace, Fosterton Hybrid (Fig. 7*b*), Dale's Hybrid (Fig. 7*c*), Early Sheepfold, Perfection, Golden Vale.

Foliage, green-tinged or slightly mottled with purple. Mid-rib and stalks green, but occasionally coloured with purple at base. Crown rounded; Fosterton Hybrid rather flatter than others. Shoulder rounded; Fosterton Hybrid a little squarer than others. Roots globe-shaped; Green Top Yellow Aberdeen, Wallace, Fosterton Hybrid, and Dale's Hybrid probably more tapering than others. Skin colour above ground-level green; below, colour varies -in Early Sheepfold, Perfection, and Golden Vale colour is a rich orange, in Green Top Aberdeen and Wallace a deep yellow, and in Fosterton Hybrid and Dale's Hybrid a pale yellow. Skin-texture smooth. Flesh yellow to light orange in colour, and moderately firm.

This group is not grown as extensively as the Purple Tops. Of the varieties listed above, Green Top Yellow Aberdeen dominates the rest, representing over 27 per cent. of the New Zealand acreage, and second only to Purple Top Yellow Aberdeen, followed by Fosterton Hybrid and Dale's Hybrid. The three are extremely difficult to distinguish one from the other.

Wallace is as yet only occasionally grown. The comments made regarding Bruce in the Purple Top Group apply also to Wallace, the two varieties being of the same origin. The variety may therefore gradually replace Green Top Yellow Aberdeen in all districts where club-root is prevalent. As Wallace can scarcely be distinguished from Green Top Yellow Aberdeen except in regard to its resistance to club-root, every precaution must be taken to safeguard the purchaser, and the production of Wallace seed in New Zealand under certification is likely to prove of considerable benefit in this respect.

(To be continued.)

SOME CAUSES OF REJECTION OF PIG-CARCASSES.*

J. E. McILWAINE, Veterinary Officer, Department of Agriculture, Palmerston North.

ONE of the first considerations in the setting of a standard in meat exports is the freedom of those exports from any suspicion of disease, contamination, or taint. It is essential that stock sent to the works for slaughter be healthy and normal in every way, be representative specimens of their breed, and carry sufficient condition to comply with the requirements of the buyer, the grader, and the meat inspector, and, lastly and probably of most importance, the stock should fulfil the requirements of the housewife and the consumer in the buyer's country. Even with provision of all the care necessary in respect to these matters occasional cases crop up where carcasses or parts of carcasses are condemned on account of bruising and accidents. Bruising is less liable to occur in the case of the pig Occasional cases of broken legs are seen, and such accidents cannot be provided for. There are, however, obvious cases of skin-disease, spoken of as necrotic or spirochætal ulcers, cases of diseased feet and deformities of one kind and another, cases of enlarged joints, and abscesses at the site of castration. These cases occur from time to time, and the farmer who provides such cases is aware of the treatment they receive when they arrive before the meat-inspection staff. Any animal with an obvious lesion is rejected at once for export ; the inspector considers the case on its merits in regard to the salvage of portion of the carcass for local consumption The entire carcasses from healthy animals are what the buyer pays for and what he expects. The meat-inspection carried out at this end is essential to prevent the condemnation of diseased carcasses arriving at the consumer's end. Farmers dissatisfied with the results obtained in regard to stock sent forward should visit the works to see the many causes for rejection.

TUBERCULOSIS.

One of the main diseases to which particular attention requires to be paid in pig-inspection is tuberculosis. The pig is particularly susceptible to tuberculosis, and once the disease has become established the pig is more susceptible to generalization of the disease than any of the other domestic animals. Tuberculosis in the pig may be contracted from the milk-supply, when it is said to be of bovine origin, or it may be contracted from fowls, when it is said to be of avian origin. In the second case the disease in pigs could be reduced substantially by not allowing the pigs and fowls to associate, and, above all, by not feeding pigs on fowls which die from obscure causes. In a case which recently came under notice a fowl was grossly affected with tuberculosis, and the farmer admitted that he was in the habit of throwing any fowls which died to the pigs for consumption. Under the regulations the feeding of raw offal from slaughterhouses to pigs is illegal, and the reason for this becomes clear from the experience cited.

Tuberculosis may affect any part of the carcass of the pig. It may, and does, affect the lungs and the pleura (hence the name pleurisy)

* Portion of an address to the Manawatu Pig-recording and Development Club.

quite commonly, so that great care is necessary in regard to the inspection of the pleura in pig-carcasses. If pigs are affected with pleurisy of a non-tubercular origin to such an extent that the pleura is damaged and requires to be stripped, the mutilated carcass is viewed with grave suspicion at the consumer's end. The first thought that will arise in the inspector's mind is that the pleura was stripped with a view to removing pleuritic lesions which may have been due to tuberculosis or to other causes. It is therefore most important that pleurisy in pigs, due to any cause whatever, be prevented by all means in the farmers' powers.

Tuberculosis in pigs is commonly seen affecting the glands of the head. If it is confined to the head only the head is condemned, and the remainder of the carcass may be passed for export. A concession was obtained in regard to such carcasses within recent years as a result of representations made by the authorities at this end. Previously only carcasses entirely free from disease, having the head intact, were allowed to be exported.

Tuberculosis may be found in the abdominal cavity, in the glands attached to the bowels, and to the liver or in the liver itself, or it may be found on the membrane covering these organs and lining the abdominal cavity. Tuberculosis may be found in any of the groups of lymphatic glands in the carcass, and, lastly, it may be found affecting the bones of the spinal column. Because of the many parts of the body subject to tuberculosis, adequate inspection of pigs is necessary at this end. A certificate is attached to each carcass which is passed for export. The certificate reads as follows: "This meat has been examined by me, and by ante- and post-mortem veterinary inspection is found to be free from disease and suitable in every way for human consumption, and the meat has not been treated with chemical preservatives or other foreign substances injurious to health." The certificate carries the signature of the veterinary officer responsible for such inspection. The inspector occupies a very responsible position, and each carcass must be judged on its merits. The inspector's position is not to condemn more than is necessary, rather is he in the position of trying to salvage as much as possible and still keep within the standard required.

Septic Conditions.

Other causes of condemnation of pig carcasses for export include, in a general sense, all septic conditions affecting the skin, joints, or flesh of the carcass. In connection with the skin, pigs have been forwarded for slaughter affected with septic barbed-wire cuts, abscesses in the scrotal region as a result of faulty castration, septic feet and enlarged joints, and large necrotic ulcers on the skin. All of these conditions can be prevented and treated by the farmer on the farm. Cuts and wounds in the pig heal with difficulty, but care and attention in keeping the wounds dressed with some antiseptic preparation prevent them from becoming septic and also prevent the development of the black necrotic ulcers. Tar is recommended as a dressing which adheres and allows healing to take place. The prevention of abscesses in the scrotal region is most important. Quite frequently abscesses are found in this region when nothing is apparent on the skin; these are described as "cold" abscesses. At the same time a small opening may be seen on the skin which leads to a big abscess situated more

deeply. These abscesses are definitely the result of careless and faulty castration of the young boars. Because of the situation of these abscesses any unnecessary excision in regard to their removal injures the hams, the most valuable cuts in the carcass. It is clear, then, that the castration of young pigs is an important operation on the pig-farm and calls for care and attention. No difficulty should be experienced provided the pigs are castrated at an early age, about three or four weeks of age. A wound in a young pig heals much more quickly than a wound in an older pig. The site of operation should be washed thoroughly. A clean knife should be used for making the incision, and the pigs should then be placed in a pen containing clean straw bedding or in a clean paddock with a fresh sward of green growth. A bold incision should be made in the skin to release the testicle ; a small cut is liable to prevent complete drainage from the wound afterwards, and if a pocket forms an abscess is liable to be the result. A suitable wound does not require any special treatment afterwards, the main essential being to keep the pigs in a clean place until healing commences. Some owners use strong disinfectants after castration, but the unfortunate sequel to the application of these is that the pig drags his hindquarters along the ground with a view to removing the irritant. The result is the immediate and direct contamination of the wounds instead of the prevention of contamination. There is no excuse for the farmer who leaves his pigs until they become older, and, as sometimes happens, castrates them a few weeks before he disposes of them as porkers. Inspectors condemn pigs for boar taint or sexual odour Such condemnations should arise only in cases of rig pigs or "stags" where the farmer is unable to castrate them. The seriousness of faulty castration and abscess-formation lies in the fact that secondary abscesses are liable to be found in deeply situated glands and the sepsis may even extend to the abdomen and set up a chronic form of peritonitis, to which reference is made later.

Any septic condition of the foot of the pig should be attended to by cleansing the foot, removing any foreign body (such as glass or wire), opening up any abscess and allowing drainage, and dressing the foot with tar and tow.

The large, ugly necrotic ulcers on the skin of pigs are amenable to treatment. These skin-lesions often are seen on pigs on farms where the drainage is bad, where the feeding-conditions are unsatisfactory, and where contamination is apt to occur as a result of the general dirty and insanitary conditions. With improved sanitation and improved methods of swine husbandry generally the formation of ulcers of this nature can be prevented. If, however, they arise, they are amenable to treatment. The treatment consists of scrubbing the sores with a brush and soap and water to remove the thick crusts. The dusting of the surface with tartar emetic (potassium antimony tartrate) has been shown to be effective in healing the sores. Many other agents have been tried and have failed to bring about recovery. These are not cases of cancer, as they have been described by some farmers. They are, however, liable to increase in size, to penetrate deeply into the flesh, even to infecting the bone, the result being unsightly and unwholesome-looking sores which render a carcass unfit for human consumption. If this skin-disease of pigs occurs on a farm and it is not possible to improve the sanitation of the pig section,

then it is necessary to move the pigs to a new area. The contaminated area should be limed and ploughed and sown down in crop. In due course the pigs may be moved back again to this area without any fear, provided reasonable sanitary precautions are then taken.

PLEURISY.

Pleurisy is inflammation of the pleura. The pleura is the very thin membrane which lines the chest cavity and covers the surface of the lungs. This same membrane is reflected and covers the heart, where it is known as the pericardial sac, taking its name from the organ which it surrounds. Thus if one speaks of pericarditis or pleurisy one is referring to inflammation of practically the same membrane in the chest cavity. Pleurisy may extend to pericarditis or pericarditis may extend to pleurisy, and frequently the two are present in the same animal.

A simple means of classification of the types of pleurisy met with in the pig may be as follows: (1) Specific types of pleurisy due to specific diseases, such as tuberculosis, pasteurellosis, or pleurisy due to parasitic invasion; (2) simple or non-specific pleurisy, which may or may not be associated with pus-formation. If pus is present in any case, the condition is described as septic pleurisy.

Tuberculous pleurisy in pigs is due to ingestion of the tubercle bacillus either in contaminated food or water. The most common source of tuberculous infection in pigs in New Zealand is the milk-supply. Skim-milk and whey form such an essential part of the diet of pigs that if the milk by-products are contaminated the pigs are likely to contract the disease from this source. Pigs may contract the disease from depasturing on paddocks which have been fouled by tubercular cattle or by tubercular fowls. Uncooked offal containing infection may be fed to pigs. Pigs may also contract the disease from one of their fellows as a result of contact. This is not common.

Prevention of infection of the food-supply, from any of the sources mentioned, is the sheet anchor in reducing and eliminating this disease from your pigs. If there is any reason to suspect the milk-supply as the source of the trouble, then the dairy herd should be examined and the cow or cows giving tubercular milk must be removed from the herds. The alternative is the boiling of all milk products before feeding them to pigs. The short life of the pig is a factor in preventing the disease from becoming as advanced as it sometimes does in the case of dairy cattle. The risk of infection of the pigs from grazing on paddocks which have been contaminated by cattle does not appear to be a serious one. The benefits obtained from such grazing under New Zealand conditions of sunshine will outweigh any risks taken. Still, there is no reason why such grazing cannot be controlled, and the risk is then removed. In a similar way the risk of infection from poultry can be controlled. Pleurisy due to chronic cases of swine-fever needs no consideration, as this disease does not exist in New Zealand at the present time. The disease of pigs known as pasteurellosis exists on a large number of pig-farms in New Zealand. The disease is an infectious type of pleuro-pneumonia which seriously affects young pigs when an outbreak occurs. Young pigs in many cases succumb to the disease, whereas there is every reason to believe that older pigs may develop chronic

lesions and survive until they reach the butcher. Affected pigs are unthrifty in appearance, have a distinct cough when disturbed, and take a longer time to fatten. Pasteurellosis is liable to break out on a farm where large numbers of pigs are kept in a crowded area and where the hygiene and sanitation of the pig-quarters leaves much to be desired. It is only natural that a lowered resistance to the disease is also brought about by inadequate and improper feeding and housing. The mortality in young pigs in New Zealand from this disease alone is alarming. There is no doubt whatever that if greater attention is paid to the cardinal matters—improved housing and feeding, and improved sanitation—the alarming mortality in young pigs would be reduced to reasonable proportions. This applies to all pigs being reared and kept on farms during the winter and spring months, when the housing, drainage, and feeding on many farms is quite inadequate to prevent the onset of disease. Better, warmer, and more hygienic types of houses are being provided, but much improvement is still needed in this respect. The old type of sty raised on stilts, exposed to cold winds in front, and subject to draughts from below, with a cesspool underneath, is most undesirable. Warmth and shelter from prevailing winds and rain are absolutely essential for all pigs, but more so in the case of young litters during the colder months. The provision of comfortable quarters reduces the feed-bill, as the animal-heat is maintained from the food-supply if it is not otherwise provided for. More use could be made of straw bedding as a protection for young pigs during the colder months. By all means utilize the grazing-system as much as possible, but if the young pigs are not occupied in grazing or feeding, then I advise that they be closed up in warm comfortable quarters where they are protected from the climatic conditions with much less risk of disease in its various forms.

Pleurisy may be due to parasitic invasion. Young pigs are subject to worms of various types. The young pigs may ingest the eggs of the parasites from the udder of the sow soon after farrowing. The eggs are swallowed and the larvæ hatch out and the particular type of worm, which is known as the lung-worm of the pig, finds its way to the bronchial tubes and lung tissue. If numerous, these worms set up localized areas of pneumonia in the lungs which may spread to pleurisy in certain cases In addition, it has been shown that the larval stage of the worm, which normally inhabits the intestine of the pig, is passed in the lungs of young pigs and is responsible for the condition known as " thumps " or " blows." If pneumonia is set up as a result of parasites, pleurisy is also liable to be present, and the adhesions of pleurisy are liable to be present when the pigs are killed

Suitable measures in regard to the prevention of all worms in pigs consists of improved drainage and sanitation and the rotational movement of pigs from paddock to paddock, infested paddocks being used for cropping

Clean farrowing-pens should be provided. The drainage of the section must be carried out well to prevent the formation of surface wallows, which are notorious beds of infection for worms and for other diseases. In surface wallows the eggs of the worms are washed into the wallows by the surface water. If a wallow is necessary for pigs in the warmer weather, let it be a concrete wallow which can be thoroughly cleansed from time to time. The concrete wallow may

also be used as a means of washing a sow's udder before farrowing, and if a layer of oil covers the water in the wallow the dressing of oil prevents lice and mange.

Probably the greatest number of cases of pleurisy in pigs is of the non-specific type. The main causes of pleurisy of this type are lack of adequate housing and lack of adequate feeding of the young pigs after weaning. There is no doubt that the greater number of such cases occurs in pigs being carried through the winter and spring months. Any factor which lowers the natural resistance and natural defensive or protective powers of the body renders the subject a prey to disease, particularly to pleurisy, and inadequate feeding lowers the resistance of all animals, and especially that of young animals. From observations on farms there is no doubt that more attention might be paid to giving more complete diets than those at present in use, and that better-balanced diets might well be provided for young, growing pigs.

In a word, the basis of the prevention of pleurisy in pigs is the provision of warmer houses during the winter months, and of comfortable and hygienic conditions and the feeding of diets which are plentiful and well balanced.

APHIDES AFFECTING CULTIVATED PLANTS.

(6) THE BLACK CITRUS APHID AND SOME OTHER TREE APHIDES.

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THE aphides dealt with in this paper are (*a*) the black citrus aphid, *Aphis citricidus*, (*b*) the poplar-leaf petiole gall aphid, *Pemphigus populi-transversus*, (*c*) the elm-leaf gall aphid, *Eriosoma lanuginosum*, (*d*) the green spruce aphid, *Neomyzaphis abietina*, and finally (*e*) the oak aphid, *Myzocallis castanicola*. The two common forms of each aphis are described below. Both these forms are viviparous—*i.e.*, producing living young—one form is winged and the other wingless. Those who might require details of the terms used in the descriptions will find them in No. 2 of this series in this *Journal* for May, 1935.

THE BLACK CITRUS APHID (APHIS CITRICIDUS).

The wingless viviparous female is approximately 2 mm. long and is black, often covered with a faint bloom. The antennæ or "feelers" are shorter than the body and are black except for some lighter patches, while the eyes are very dark red, almost black. The legs are fairly light in colour with black patches.

The winged viviparous female is approximately 2 mm. long and is black also. The eyes are very dark red, while the antennæ are dusky with light patches, and are almost as long as the body. The legs are light with black areas.

HOST PLANTS IN NEW ZEALAND.

Found so far only on citrus.

OBSERVATIONS.

In New Zealand this is the common black aphid of citrus, and appears to be present wherever its host plant is grown. The winter is passed in the normal summer stages on citrus, but the rate of development is so slow that the numbers of the insect appear to be very small. In the spring these colonies take on a new lease of life and the young growing portions of the tree rapidly become covered with the pests. Fortunately this aphid is much parasitized, otherwise it would prove to be a much more serious pest.

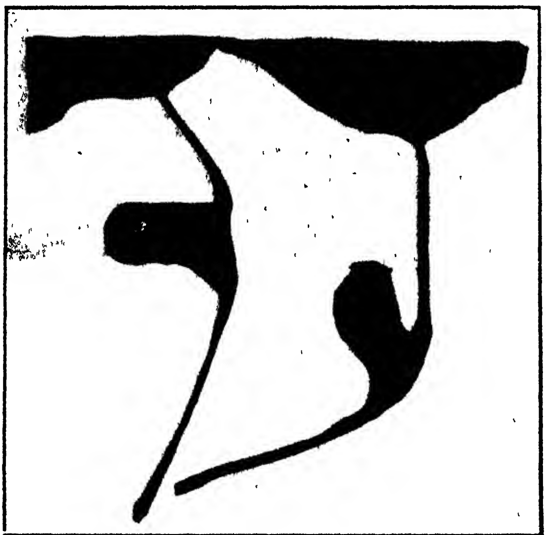

FIG 1 GALLS ON LEAF PETIOLES OF POPLAR CAUSED BY PEMPHIGUS POPULI-TRANSVERSUS. [*After Miller.*

THE POPLAR-LEAF PETIOLE GALL APHIS (PEMPHIGUS POPULI-TRANSVERSUS).

The wingless viviparous female is from 2 mm. to 2·5 mm long and in colour is a clouded pale yellow. The antennæ are very short, much shorter than the body. The legs are dark brown to blackish.

The length of the winged viviparous female is approximately 2 mm. The head, antennæ, and thorax are black, while the legs are also black. The abdomen is a clouded light greenish-yellow without markings, the whole body being coated with a light covering of grey powder. The antennæ are much shorter than the body, and the wings are slightly smoky.

HOST PLANTS IN NEW ZEALAND.

Poplar.

OBSERVATIONS.

This aphid is the cause of the formation of characteristic galls on the petioles of poplar-leaves (see Fig. 1). These galls are from ½ in. to 1 in. long when full-grown and are hollow, being provided with a small mouth-like opening at one end. Wingless females are the inhabitants

of these structures. During the late summer and the autumn winged aphides appear in the colonies and escape from the galls by means of the openings. These winged aphides fly to cruciferous plants such as rape, turnip, cabbage, and various cruciferous weeds, and thereon produce colonies of wingless aphides which migrate to the roots, the winter being passed underground in this way. In the spring winged forms make their appearance in the root colonies and these fly back to the poplars and produce male and female forms. This is the only time of the year at which the male is to be found. Each female lays a single egg. The individuals which hatch from these eggs settle on the petioles of the young developing leaves and cause new galls to form, inside which the aphides are soon enclosed.

FIG. 2. GALLED ELM-LEAVES CAUSED BY ERIOSOMA LANUGINOSUM.
[After Miller.

In this country, as a rule, this aphid causes no appreciable economic loss, the only apparent effect being the disfiguring of the leaf petioles of the poplar.

THE ELM-LEAF GALL APHID (ERIOSOMA LANUGINOSUM).

The wingless viviparous female is green to black and is approximately from 1·5 mm. to 2 mm. long. The body is shiny, with much mealy and white cottony material. The eyes are small and black. The antennæ are much shorter than the body.

The winged viviparous female has the head and thorax black, with the abdomen also dark. The whole body is mealy, and white cottony filaments are produced from the posterior portion. The eyes are black but are much larger than in the wingless form. The length of the body is from 1·5 mm. to 2 mm., while the antennæ are much shorter than this.

HOST PLANTS IN NEW ZEALAND.

European elm and pear.

OBSERVATIONS.

This aphid causes the formation of galls on the leaves of the elm (see Fig. 2). In the winter these galls often commonly persist on the tree as black dried remains, and are quite conspicuous when all other normal leaves have been shed. The aphides live inside these malformed leaves, the interior of the nests also containing a quantity of mealy and waxy substance or sticky fluid. The life-history of this insect in New Zealand has been worked out by Dumbleton (*N.Z. Jour. of Sci. and Tech.*, Vol. XVI, No: 3). Overwintering on the elm takes place in the egg stage. In the spring the eggs hatch and the young commence feeding on the developing leaves, and so cause the formation of galls which by the first week of November are quite small. The galls are fully grown about mid-December, and at this time winged aphides appear in the colonies and are ready to migrate. This migration takes place to the roots of pear-trees. Several generations are produced on the pear roots until the autumn, when winged forms fly back to the elm to produce sexual forms which lay the overwintering eggs, and so the cycle is completed. Colonies of the wingless aphides may also overwinter on the pear roots without having recourse to the egg stage. It is stated that on pear this aphid can cause severe damage, but in New Zealand experience with this species is very limited, and the insect does not seem to be of great importance as yet.

THE GREEN SPRUCE APHID (NEOMYZAPHIS ABIETINA).

The wingless viviparous female is green and from 1 mm. to 1·5 mm. long. The eyes are red and the antennæ dusky, these latter being approximately half the length of the body.

The winged viviparous female is light green, with the head and thorax darker. The eyes are red and the antennæ dusky, these latter being almost as long as the body, which is from 1 mm. to 1·8 mm.

HOST PLANTS IN NEW ZEALAND.

Spruce.

OBSERVATIONS.

This aphid causes injury to the spruce by sucking the sap from the needles. Very severe damage can be caused, badly attacked trees being severely defoliated (see Fig. 3). The insect is distributed over both the North and the South Islands. According to Dumbleton (*N.Z. Jour. of Sci. and Tech.*, Vol. XIII, No. 4), the numbers of this aphid on the spruce are scarce during the summer, but increase through the winter up to November, after which month the numbers decrease again until the winter. Thus breeding continues throughout the year, there being no egg stage.

THE OAK APHID (MYZOCALLIS CASTANICOLA).

The wingless viviparous female is yellow to yellowish-green, ornamented with black spots, and presents a somewhat flattened appearance. The eyes are black, while the antennæ are yellowish with dark bands, and are shorter than the body. The length of the insect is from 1·5 mm. to 2 mm.

The winged viviparous female is usually pale yellowish or greenish, ornamented with dark patches. The eyes are very dark. The antennæ are pale, ornamented with dark rings, and are almost as long as the body, which is approximately 1·5 mm. The body bears several tubercles.

FIG. 3 SPRUCE KILLED BY NEOMYZAPHIS ABIETINA: OREGON PINE ON EACH SIDE UNATTACKED. [*After Miller.*

HOST PLANTS IN NEW ZEALAND.

Oaks

OBSERVATIONS.

This is a very common aphid, it being possible to find the insects on almost any oak foliage during the summer. Although it is so common, it does not seem to cause much injury. It is very

probable that the species lays eggs at the bases of the buds on oak-twigs to carry over the winter. The writer has found aphid eggs in such places on oak, but is not certain that they are of this species.

CONTROL.

For the control of the black citrus aphid, spray with nicotine sulphate 1 part to 800 parts of water plus soft soap at the rate of from 3 lb. to 4 lb. per 100 gallons of spray. However, the ordinary summer oil spray 1–60 used for red-scale on citrus will also control the black aphid. For the other aphids mentioned in this paper no chemical treatment is suitable on a large scale, the cost being prohibitive.

However, for ornamental trees use a spray of nicotine sulphate 1-800 plus soft soap as mentioned above. Summer oil may also be used at the rate of 1 part to 80 or 100 parts of water.

CONCLUSION OF SERIES.

This article concludes the series on the aphides, as all those species of sufficient economic importance have been treated. Actually there are many more species in the Dominion, and it is hoped to publish complete information on them at a later period.

EELWORM DISEASE OF CHRYSANTHEMUMS.

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IN March of this year a serious disease of chrysanthemums in the Palmerston North district was reported to this Station. On inquiry it was found that the disease first appeared after a period of heavy rainfall and high humidity prior to the 1st of January, but at that time only a few plants were affected and little attention was paid to the initial outbreak. A survey in March showed that the majority of the gardens were affected, though the amount of disease present varied considerably. At this time the plants were fully grown and selection of buds had taken place in preparation for show purposes Many of the growers had been watering heavily and applying liquid animal-manure to force the plants, and in these gardens the disease was worst. Where the plants had not been so forced or where varieties, as the single or decorative types, required less attention, the disease was negligible.

SYMPTOMS.

The early symptoms consisted of leaf discolorations which showed as small areas $\frac{1}{8}$ in. to $\frac{1}{2}$ in. in diameter slightly darker than the normal leaf. At first these areas were scarcely noticeable, but later became reddish-brown, and finally dark-brown or black. In this latter condition the diseased areas were sharply delimited by the leaf-veins forming the characteristic symptoms of the disease (Fig. 1). The lowest leaves were the first affected, and usually those parts of the leaves adjacent to the petioles showed the first lesions (Fig. 2), from which the disease spread over the leaves and

to the foliage above. On those plants infected early in the season most of the lowest leaves were black and withered, there being only a few green or partly green leaves on the upper stem, while in many plants the flower-buds and pedicels showed blackened portions. The roots, stems, and midribs did not exhibit any discoloration.

Cause of the Disease.

Tests for the presence of pathogenic fungi, bacteria, and viruses gave negative results, but a microscopic examination of the blackened areas showed within the leaf numerous eelworms in all stages of development from egg to adult. Eelworms were also isolated from

FIG. 1. TYPICAL LEAF-LESIONS DUE TO EELWORM-INFECTION.

the small, slightly dark areas on the leaves, but were not found in the roots, stems, petioles, midribs, or the new shoots from the root stocks. These eelworms are minute, colourless, thread-like parasites, only visible by the aid of a microscope, and similar in appearance to the organism responsible for eelworm disease of bulbs.

According to advice received from the Imperial Institute of Entomology the causal organism is *Aphelenchoides ritzeam-bosi* Schwartz, which is a recognized parasite of chrysanthemums in other countries. According to European investigators this eelworm is strictly a plant parasite, but in the absence of a suitable host is able to remain alive for some years in the soil or in dried chrysanthemum-leaves, and once the soil is contaminated it is a source of infection for future plantings.

Infection of the growing plants takes place through the leaf tissue, the parasites moving from the soil up the outside of the stem and entering the leaves through the stomata or through injuries. This movement of the eelworms is assisted by, but not dependent on, moist warm conditions.

In addition to chrysanthemums other plants are attacked by this eelworm, and these form additional sources of infection should the soil be used subsequently for the growing of chrysanthemums. These hosts are *Adenostyles* sp., *Doronicum* sp., *Aster* sp. (michaelmas daisy), *Elsholzia cristata* Willd., *E. Patrini* Garcke, *Calceolaria* sp.,

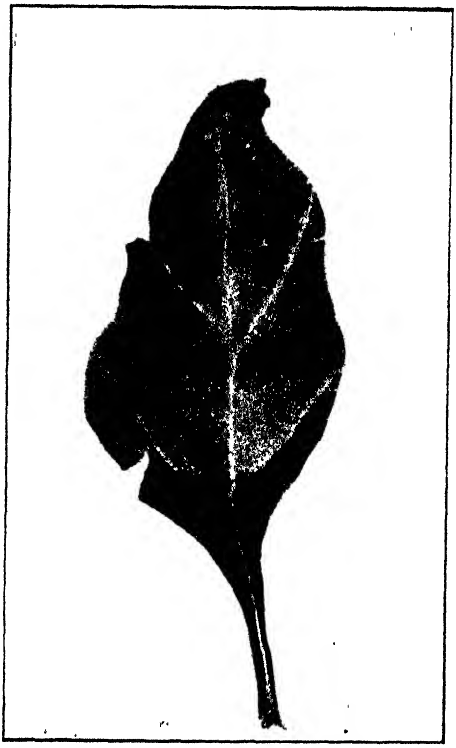

FIG. 2 AN EARLY STAGE OF EELWORM-INFECTION OF CHRYSANTHEMUM-LEAF.

Callistephus sp. (China aster), *Gloxinia* sp., *Pentstemon barbatus* Roth., *Chelone barbata* Cav., *Oncium* sp., *Phlox Drummondii* Hook., *Ranunculus repens* Linn. (creeping buttercup), *Chrysanthemum leucanthemum* Linn. (dog daisy), *Rudbeckia* sp., *Senecio vulgaris* Linn. (groundsel), *Valeriana montana* Linn., *Verbena venosa* Gill. and Hook., *Dahlia* sp., *Zinnia elegans* Jacq., *Delphinium* sp.

Control of the Disease.

Apparently no completely reliable control of the disease has yet been devised, but the work of some investigators has suggested general recommendations which are helpful in reducing the amount of infection. All dead leaves and infected parts should be removed

from the beds and burned, while between seasons the beds should be disinfected or replaced with soil known to be clean. Steaming is the most satisfactory method of disinfecting soil, and for this purpose a pressure boiler and harrow are necessary, but the cost for small areas may be prohibitive. An alternative to steaming is the replacement with soil from an uncontaminated area, and this is satisfactory provided (1) the soil is replaced to a depth of at least one foot and (2) the paths and borders of the bed are also replaced. Soil treatments with chemicals for the control of chrysanthemum-eelworm appear to be of doubtful value, and would be used only when steam-disinfection and replacement of the soil are impracticable. Apparently the only treatment which may be effective is the use of carbon disulphide.*

The system of propagating chrysanthemums by cuttings adds to the difficulty of controlling the disease, for by them the disease is often transmitted from season to season. The cuttings should be washed to remove adhering soil, dipped in a lime-sulphur plus colloidal-sulphur spray,† and struck in eelworm-free soil. During the growing period, both before and after planting out, the plants should be sprayed at least once each week with the above spray, which is also of service in controlling mildew and rust. A strong solution of nicotine sulphate (1–400) is also suggested as a good spray immediately after planting out, but frequent applications for two or three weeks are necessary. Another method of control is to prevent the eelworms from ascending the plants by placing a ring of vaseline or birdlime around the stem. This ring should be renewed as the stem increases in thickness, and care must be taken to prevent the lower leaves from touching the soil or adjacent plants.

Since no one method alone seems to be a satisfactory control for the disease, it is advisable to adopt a number of the above suggestions. At the present time some of these are carried out in part, but not with sufficient thoroughness to prevent the spread of the parasite.

In addition, growers should be careful when handling plants not to transfer infection by hands or implements from the ground or from one plant to another. Last season it appeared that indiscriminate handling increased the spread of the disease and was largely responsible for the transmission of eelworms to the flower-buds.

SUMMARY.

A disease of chrysanthemums new to New Zealand is due to infection by eelworm, probably *Aphelenchoides ritzema-bosi* Schwartz.

The symptoms are shown in the blackening of the leaves and portions of the flower-buds, while the roots, stems, and midribs are not affected.

* Carbon disulphide is used at the rate of 14 fluid ounces per 3 square yards, ¼ fluid ounce being injected every foot over the area to be treated. The injection holes should be made from 4 in. to 6 in. deep, and immediately after the introduction of the carbon disulphide each hole must be filled in. The bed subsequently should be covered with sacking for twenty-four hours. This treatment should be applied a few days before planting the bed. *Caution :* Carbon disulphide is poisonous, inflammable, and explosive, but when handled carefully there should be no danger to the operator.

† Lime-sulphur 0·083 per cent. polysulphide content plus colloidal-sulphur at 2 lb. per 100 gallons.

Soil treatments suggested to reduce the amount of infection are steam disinfection or replacement of the soil, or, where these are impracticable, the injection of carbon disulphide.

Cuttings should be washed free of soil, dipped in lime-sulphur-colloidal-sulphur, and propagated in eelworm-free soil.

Constant spraying with lime-sulphur plus colloidal-sulphur is advocated, and applications of strong solution of nicotine sulphate in the early growth stages are also suggested.

Ringing the stems with birdlime may be useful.

Finally, the indiscriminate handling of plants is to be avoided.

FIG. 3 CHRYSANTHEMUM SHOWING THE EFFECT OF INFECTION

Note withered basal leaves and destruction of one flower-bud

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THE GERMINATION OF PERENNIAL RYE-GRASS IN THE SOIL AND IN THE LABORATORY.

E. O. C. HYDE, Assistant Seed Analyst, Palmerston North.

IT may be superfluous to state that in testing the germination of agricultural seeds the object is to determine the capacity of the seed to produce plants when sown in soil under favourable conditions. The most direct method of achieving this object is to use soil as the medium for germination tests. However, from considerations of economy, urgency, and the necessity for uniformity of treatment, the testing of seeds for germination is carried out not in soil, but under highly artificial conditions. The temperature, and the supply of moisture, air, and light, are all controlled, and each kind of seed is placed under those conditions which much experimenting and long experience have shown to be most conducive to complete and rapid germination.

The utility of tests made under these artificial conditions depends on the degree to which such tests can be relied upon as a measure of the capacity of the seed to produce plants under favourable soil conditions. It is therefore imperative that the comparative results of germination in soil and under the standard artificial conditions in the seed-testing laboratory should be investigated as fully as possible. Only with the aid of such information can the most effective use be made of the results of germination tests.

The present article records the results of a series of these comparative tests in which a number of samples of certified perennial rye-grass seed were employed. It was thought that these results would be of interest in view of the frequent assertions that laboratory germination tests do not provide a reliable means of gauging the germinating-capacity of perennial rye-grass seed in the field.

One hundred and eight samples of certified perennial rye-grass seed were collected, including samples from all the main seed-growing districts. Samples of high and of medium germinating-capacity were well represented, but comparatively few samples of very low germinating-capacity were available. The samples were all of the 1934 harvest. The tests were made in September and October, and therefore the possibility of the results being influenced by incomplete after-ripening can be dismissed.

For the laboratory tests three lots of 100 seeds from each sample were used. The seed was incubated on moist filter paper in a chamber-germinator. The temperature was raised to 25° C. during the day and allowed to fall to 18° C. at night. The "interim" count was made on the sixth day and the final count on the twelfth day.

For the soil tests a light sandy loam was used. This had previously been heated in a steam-sterilizer sufficiently to kill most of the weed-seeds. Four lots of 100 seeds were employed for each test. The seed was sown about ½ in. deep and in straight drills to facilitate counting. The soil was kept in a moist condition, but the boxes were preserved by means of a cold frame

from excessive soaking and from interference by birds. In short, an effort was made to provide conditions uniformly favourable for germination and seedling establishment. The seedlings began to appear on the eighth day, and counts were made on the fourteenth and twenty-first days. There was seldom any additional germination after the fourteenth day.

The results for the germination tests in the laboratory and in soil are presented concisely in the correlation diagrams (1) and (2).

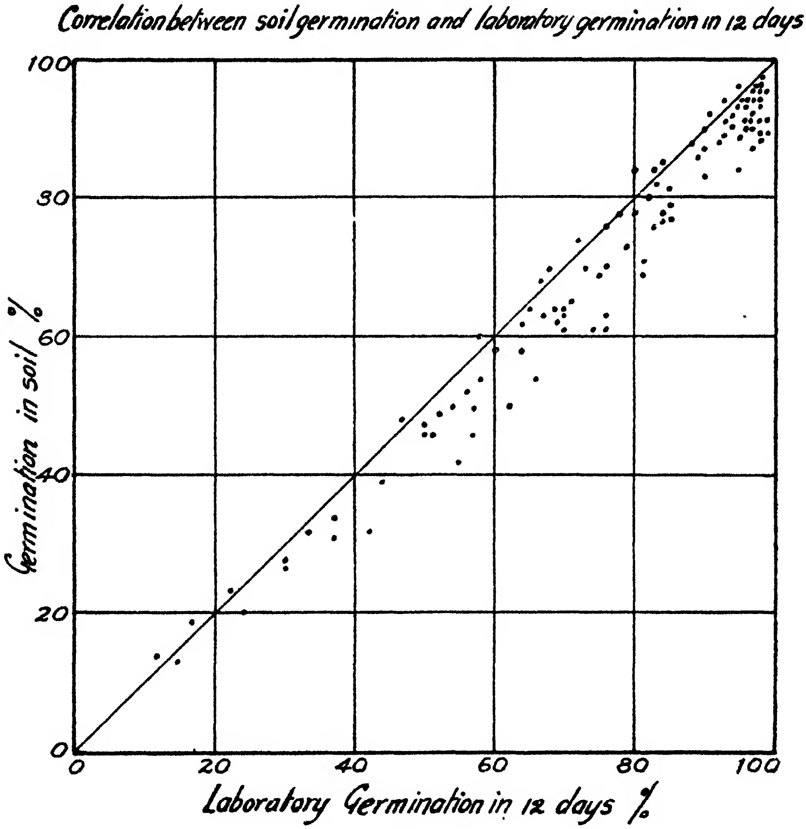

DIAGRAM 1.

In diagram (1) each sample is represented by a dot. The position of the dot measured on the vertical scale indicates the percentage germination in soil, while the position of the dot on the horizontal scale indicates the germinating-capacity in the laboratory. Dots lying above the line running diagonally from left to right denote samples of which the percentage germination in the soil exceeded that in the laboratory. The converse applies to samples represented by dots lying below the diagonal line. Diagram (2) in a similar manner demonstrates the correlation between percentage germination in soil and percentage germination in the laboratory

in six days. In the generalized diagram (3) the percentage germination in the laboratory is plotted against the ratio of the germination in soil to that in the laboratory, the germination in the laboratory being taken as 100. In the table the samples have been grouped according to their germinating-capacity in the laboratory. The average percentage germination and also the ratio of soil germination to laboratory germination are shown for each group.

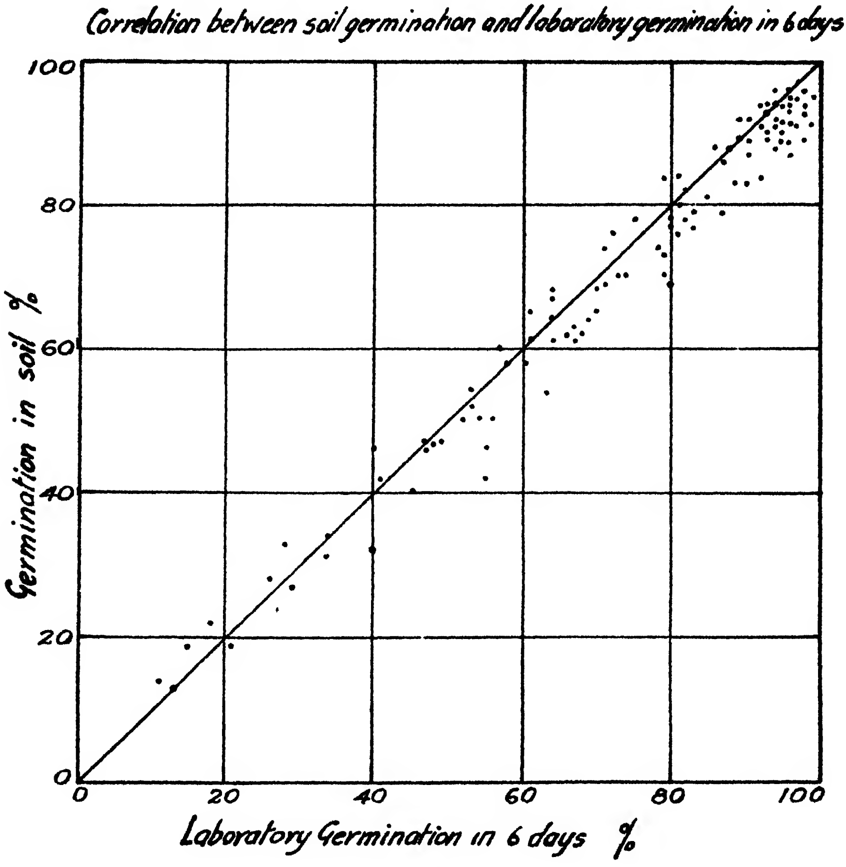

DIAGRAM 2.

Results of Comparative Germination Tests in Soil and in the Laboratory.

Laboratory Germination in Twelve Days (per Cent.).	Number of Samples.	Average Germination (per Cent.).			Ratio of Soil Germination to Laboratory Germination.	
		Laboratory, Six Days.	Laboratory, Twelve Days.	Soil.	Laboratory Germination in Six Days = 100.	Laboratory Germination in Twelve Days = 100.
0 to 40 ..	8	20	22	21	105	95
41 to 60 ..	16	46	50	45	98	90
61 to 80 ..	27	67	70	65	97	93
81 to 100 ..	57	90	92	88	98	95

It is apparent that the ratio of soil germination does not change markedly with different levels of germinating-capacity in the laboratory. When the twelve-day count is employed the ratio falls a little with decreasing laboratory germination until the samples of lowest germinating-capacity are reached, when the ratio rises slightly. When the six-day count is employed the ratio is more nearly constant at all levels of germinating-capacity, but again increases a little with samples of lower germinating-capacity.

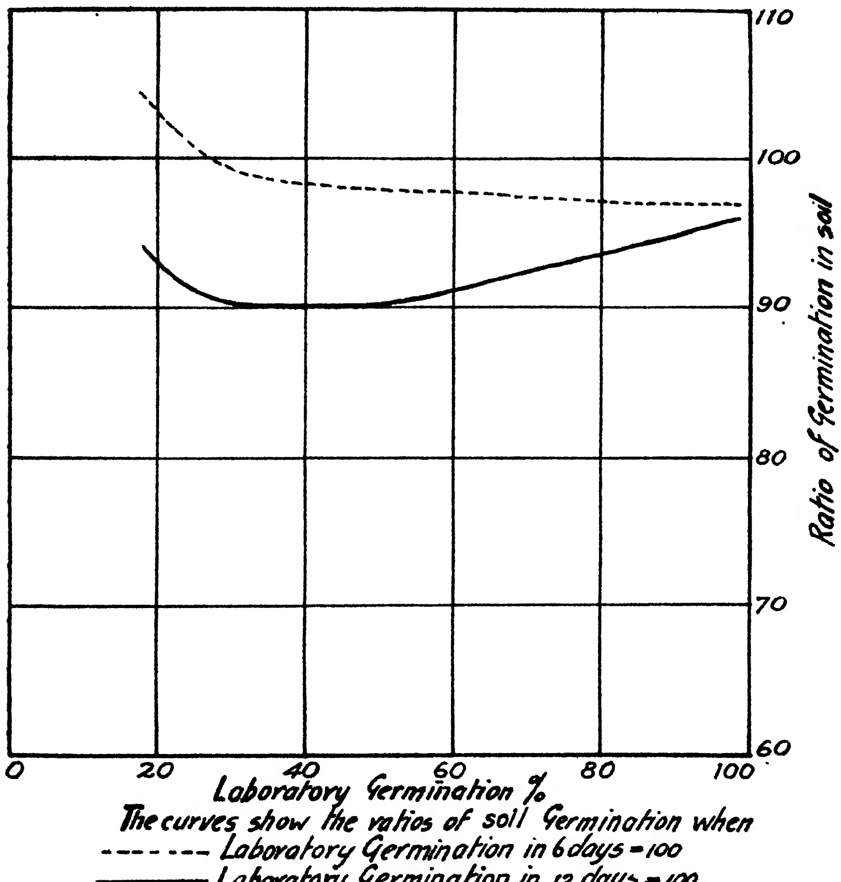

DIAGRAM 3.

In experiments of this kind it is generally found that the ratio of soil germination to laboratory germination falls considerably with decreasing germinating-capacity. Consequently, when sowing seed of low germinating-capacity it is usually necessary, in order to produce satisfactory results, to increase the rate of sowing to such an extent that the quality of pure germinating-seed used is much greater than would be required if seed of high germinating-capacity were sown. In explanation it is assumed that the influences which have caused the death of a proportion of the seeds have also

impaired the vitality of those that remain alive. This explanation appears satisfactory where the low germinating-capacity is the result of age or of unfavourable harvesting or storage conditions.

An examination of the data presented here shows that the generalizations outlined above are not always applicable to rye-grass seed. The samples of rye-grass seed of low germinating-capacity are peculiar in that they show a ratio of soil germination to laboratory germination as high, or indeed slightly higher, than is the case with seed of high germinating-capacity. The samples dealt with in the present work were only a few months old, and there was no evidence of excessive injury at harvesting or in storage. The low germinating-capacity of some of the samples was due in a great measure to the attacks of a parasitic fungus which invades the developing seed.* The vitality of the seed which has escaped destruction seems to be in no way impaired. It may be expected confidently when rye-grass seed of low germinating-capacity is used that if the rate of sowing is adjusted in inverse proportion to the germinating-capacity the seed will give satisfactory results in the field.

The present work has shown that the standard laboratory technique employed in germination tests of perennial rye-grass seed is satisfactory, and that results of laboratory tests serve very well for practical purposes as a direct measure of the comparative germinating-capacity in soil. For this purpose the "interim" count in six days is somewhat to be preferred to the final count.

The appreciably higher ratio of soil germination to laboratory germination for samples of low germinating-capacity is of some technical interest. It is unfortunate that so few samples of very low germinating-capacity were available. An effort is being made to procure a larger number of such samples in order that the matter may be investigated further.

* HYDE, E. O. C.: Germinating-capacity of Perennial Rye-grass Seed. *N.Z. Journal of Agriculture*, 44 (5); 316–319, 1932.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 5th September, 1935, to 19th September, 1935, include the following of agricultural interest:—

No. 74386: Horse-shoe; M. van Gestel. No. 74416: Power-taking-off gearing; Andrews and Beaven, Ltd. No. 74421: Implement-handle; Baker, MacPherson, and Co., Ltd. No. 71752. Grab-hook; W. Grant and R. I. Brake. No. 73213: Cleaning animal intestines; R. J. Bartley and S. H. McCartney. No. 73239: Animal-trap; S. H. Knapp. No. 73337: Separator-clutch; C. T. Foote. No. 73407: Teat-cup claw; A. B. Robertson. No. 73483: Separator-clutch; Cognate with No. 73337 above. No. 73899: Weighing of animals; C. Smith. No. 74103: Emulsifying hydro-carbons; M. F. Lamb.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

For the first time, the annual value of pig-meat exported exceeded £1,000,000, 485,677 cwt., valued at £1,313,502, being exported for the year ended 30th June, 1935, the corresponding figures for the previous years being 397,031 cwt. and £950,183.—*Minister of Agriculture, Annual Report.*

THE EARLY PROGRESS OF THE ROMNEY LAMB AND FEATURES IN THE DEVELOPMENT OF THE FLEECE.

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THE purpose of this article* is to describe certain features in the early development of the fleece which have been the accompaniment of poor growth of the lamb. These features are to be attributed to external factors causing the lambs to grow slowly, sometimes very slowly, rather than to inherited make-up, for seasonal and feed conditions, or the total complex of non-genetic factors, were unfavourable, though it is true that some of the lambs here reported upon grew less well than other lambs kept with them.

It is not possible to state that particular early conditions bring about a specified loss of profit from the fleece. What it is desired to explain is that certain definable features can be correlated with poor progress of the young lamb, so that unfavourable conditions at the beginning of the animal's career appear to have marked effects upon the coat. We may therefore think of the skin and the fibre-roots as responsive to the treatment bestowed upon the lamb. It is this sensitive response to external factors which it is sought to emphasize.

An understanding of the effect of non-genetic factors on the lamb's coat is desirable so that we may ultimately know: (i) How to make allowance in selection for the effects of environment and nutrition; (ii) what are the results in profit and loss from the fleece of variations in the ordinary conditions to which young lambs are exposed; and (iii) how to modify to our own advantage—it may be by some very artificial device—the normal growth of the fleece.

The recognition of the different fibre types which have been described in earlier papers has made it possible to observe the details in the development of the coat of the lamb which are to be presented. Some of these features are of a kind not possessing obvious direct practical interest, but the failure to add new fibres to the fleece at a time when normally there is an increase in the number of fibres may be cited as a matter which merits investigation from the standpoint of fleece weight.

The features accompanying poor growth of the lamb are more marked in some fibre types than others. On present evidence it does appear that the first-founded follicles—those of halo-hairs—can stand up well when the lamb is growing poorly, whether before birth or afterwards. In sickle-fibres and in curly-tip fibres certain features can be correlated with poor growth in the early weeks of life, and it is concluded that histerotrichs—fibres without definite curls in the tips—may actually be prevented from beginning to grow in anything like normal abundance. It appears, therefore, that the later it be the turn of a follicle to develop the greater tend to be the effects of the factors causing a lamb to grow abnormally badly.

* Earlier articles on the coat of the Romney lamb have appeared in this *Journal* in 1933 and 1934.

The statements now to be made about the various classes of fibres have reference to the middle-line of the back near the level of the attachment of the last rib. It is this region of the body which has been studied more closely than any other.

HALO-HAIRS AND THEIR SUCCESSORS.

Halo-hairs.—As indicated already, there is very little in the performance of the follicles of halo-hairs, whether these follicles be growing halo-hairs or later fibres after the shedding of their first occupants, that can be correlated with poor growth of the lamb. It will be explained in dealing with sickle-fibres why the shedding of these fibres, in contrast with persistence or indeterminate growth, is looked upon as an expression of vigour on the part of the follicle. It is a very rare happening for a halo-hair not to be shed, and when the growth of a few halo-hairs has been persistent it has not been possible to connect this with poor growth of the lamb. With sickle-fibres, as will be reported directly, the position is different.

It was suggested to me by Mr. A. Leslie, of Lincoln College, that pre-natal conditions may affect the abundance of halo-hairs. It is likely that the same kind of follicle is the potential producer of a halo-hair, a super-sickle-fibre, or a sickle-fibre. The belief that this is so is based primarily on Miss N. Galpin's study of the pre-natal development of the coat. Another reason is that halo-hairs are very occasionally persistent in growth, and an additional piece of evidence comes from the study of fibre succession in the follicles or birthcoat kemps. Commonly enough halo-hairs are followed in the same root by shed hairy fibres—that is, by secondary kemps—and so now and again are super-sickle-fibres, but very rarely indeed do kemps follow shed hairy sickle-fibres. In one only out of some eighty lambs was there evidence that this occurred, but in this exceptional animal there was enough secondary kemp amongst the immediate successors of the shed birthcoat kemps for all the shed hairy sickle-fibres to have been succeeded by kemps. This single lamb, however, lends considerable support to the view that the follicles of halo-hairs and of sickle-fibres are not of essentially distinct sorts.

In her work on the pre-natal development of the coat Miss Galpin often has occasion to think in terms of density of follicles in the expanding skin. In view of this, and of the conclusion stated in the last paragraph, it would be easy to understand how different rates of growth of the fœtus could help or hinder the first-founded follicles. If the original follicles became crowded through poor expansion of the skin we could understand how they might give rise to smaller fibres, to super-sickle-fibres, or sickle-fibres instead of halo-hairs. If, however, the increase in size of the lamb were much below normal just after the earliest follicles had been laid down we could suppose the founding of further follicles to be hindered and then we could understand how the earliest follicles, being left in consequence with more ample room in their early stages, might the more readily give rise to halo-hairs. The evidence now to be given on the point under consideration may most safely be said to be merely negative, but if it be indeed that poor pre-natal growth of the lamb has little or no effect on the abundance of halo-hairs this will be a contribution to our understanding of the architecture of the fleece.

In 1931 the lambs born in my breeding-work at the Massey College were weighed as soon as they were found in the paddock during their first twenty-four hours. The average birth-weight of lambs with no halo-hairs on the back (Grade 1) or with few (Grade 2) was less than that of lambs with medium numbers or many (Grades 3 to 6), the difference being three and a half times its probable error In the first group, with no halo-hairs or few, out of ninety-five lambs sixteen weighed 7 lb or less, but in the group with more halo-hairs only one out of forty-two was so light. These differences between the groups may be real, but they are by no means certainly more than a matter of chance.

At the Canterbury Agricultural College at Lincoln in 1934 more extensive material was very kindly placed at my disposal by Professor R. E. Alexander, Mr. Leslie, and Mr. D. J. Sidey. There I graded more than a thousand lambs by Southdown rams from a variety of ewes, including Romneys, Border Leicesters, Corriedales, half-breds (longwool cross Merino) and three-quarter breds (longwool cross half-bred). The breeding of the lambs at the two colleges was, of course, different, but the halo-hairs on the lambs at Lincoln College were to all appearances the same as those of Romneys. In the South Island lambs it came about that animals weighing 7 lb. or less were plentiful because many of the ewes had been kept in hard conditions in accordance with a research scheme on very different problems. In this abundant material the proportion of lambs weighing 7 lb. or less at birth was actually less amongst animals with no halos or few on the back than in lambs with more than few. Thus, of Mr. Leslie's experimental lambs with no halos or few, 151 were light, 702 were heavy ; of these, with more than few, nineteen were light and forty-two heavy. This difference between the two groups, however, like any difference in average weight, is not statistically significant.

At both colleges twins were much more plentiful amongst the lambs of 7 lb. or less than in heavier lambs, but no light was thrown on the problem by examining the distribution of singles and twins in the "None or few" group and in the "More than few" group.

An analysis was made of data for the britches of the Lincoln College lambs. On the britch the numbers of halo-hairs per unit area are commonly much larger than on the back Again the figures revealed no connection between birth-weight and grading for halo-hairs.

The best evidence of a connection between birth-weight and abundance of halo-hairs is afforded by a pair of twin Romney lambs born in 1932 in one of my breeding-experiments, both parents having had many halo-hairs. These lambs, which were born dead at what was known to be full term, were both extremely small and can have weighed only about 4 lb. each. None of my lambs with many halo-hairs has ever been so small as this at birth. These lambs were classed as Grade 2 (few) for halo-hairs on the back, but fibres, judged to be large super-sickle-fibres, were very plentiful. It is most unusual to find big-ended super-sickle-fibres abundant unless typical halo-hairs are plentiful, and it is therefore quite likely that in these twin lambs many fibres failed to become halo-hairs because the pre-natal development of the lambs was so poor.

The two lambs just described were, however, so abnormally small that they throw no light on the relation between variations in birth-weight ordinarily found and abundance of halo-hairs. Within the range of variation that is at all common the contemplation of the records

from the two agricultural colleges leaves the question of the relation between birth-weight and abundance of halo-hairs still open, and it does not appear very likely that any relation will be established.*

The whole question of the relation between the pre-natal progress of the lamb and the development of the fleece could be investigated to advantage in a breed showing less variation in coat-characters than the Romney.

Shedding of Successors of Halo-hairs.—The fibres following shed halo-hairs in the same roots are themselves sometimes shed, sometimes not. In a preliminary report (this *Journal*, June, 1934) a statement has been made about the shedding of these immediate successors of halo-hairs on the standard back position. In lambs with sickle-fibres in the array—that is, when the array is Saddle (or All-in), Ravine, Valley, or Plain—and with coarse hairiness in persistent birthcoat fibres not sustained definitely below the crisis level—that is, not produced beyond about the third month — free shedding of the immediate successors of halo-hairs is correlated with free shedding—usually three out of four—of sickle-fibres with large ends.

One lamb (E. 631 of 1932, Grade 4 for halos) in which a substantial majority of the big-ended sickle-fibres was shed grew very badly all the time, save possibly in the very early weeks, and died, miserably small, at seven months. By this time it could be ascertained, by pulling, where necessary, the fibres succeeding halo-hairs which had been marked by tying them, singly, in tiny bundles of other fibres, that nearly all the successors of halo-hairs were secondary kemps.

More recently succession on the back has been studied in the Plateau array, which includes no sickle-fibres, or such small numbers of them that they are regarded as not occupying a place in the array proper, but as standing in parallel. In this array the series runs from halo-hairs to super-sickle-fibres, to the biggest curly-tip fibres, which are often hairy in the pre-natal tip. Often the differences between the three groups of fibres, both in pre-natal and post-natal regions, are relatively slight, all being of lusty growth before birth and grossly hairy afterwards.

It is clear that for succession when the fibre-type array is Plateau it will be possible to establish an orderly generalization corresponding with that stated above for the other arrays. It has been concluded tentatively that in the Plateau array free shedding of the successors of halo-hairs takes place when there has been free shedding of a certain type of super-sickle-fibre. One lamb (E. 922 of 1934, Grade 6 for halos) with free shedding of those super-sickle-fibres grew badly, and was lamentably light at nine months, but in spite of this poor progress most of the successors of halo-hairs proved to be secondary kemps.

The shedding of hairy fibres, which are kemps precisely because they do shed, instead of continuing to grow, is thought of—to repeat an old statement—as a vigorous thing. Yet in the two lambs just reported upon in which the successors in halo-hairs were regarded, for the reason given, as destined to be shed, shed they were, in spite of prolonged poor growth of the animals. These two lambs were the only ones followed up in which free shedding of certain sickles and super-sickles occurred in animals which turned out to grow so poorly.

* That any such relation exists has become still less probable in the light of an analysis of birth-weight data from 110 lambs born in my 1935 breeding experiments on the inheritance of the abundance of halo-hairs. Nevertheless, the possibility must be recognized that the abundance of halo-hairs might be affected by non-genetic factors acting for a short time when the fœtus is comparatively young.

One other lamb (E. 545 of 1931, Grade 5 for halos, Ravine array) seems also to throw light upon the question under consideration. This lamb is known from weight records to have grown slowly for about its first three months, but afterwards, including the time when the successors of halo-hairs have completed their growth if they are to be shed, to have thrived better. Amongst other features to be associated with the poor progress of this lamb is the persistence of all the sickle-fibres on the standard back position. With none of the sickle-fibres shed one would ordinarily find very few of the successors of halo-hairs to be shed, whether or not the chalky region of the coarser persistent medullated birthcoat fibres extends—and in this lamb this does not happen—definitely below the crisis-level. Nor, indeed, in the conditions described would one expect the successors of the shed birthcoat kemps (halo-hairs and super-sickle-fibres) to show much hairiness.

In lambs making normal progress, with chalkiness not sustained below the crisis level, poor shedding of sickle-fibres, whether they be hairy after birth or finer, is attributed to the check given to their follicles at an early stage of development by the pre-natal check. This check is believed to impair at the same time the vigour of the halo-hair follicles, so that the fibre succeeding the shed halo-hair has a reduced chance of being a secondary kemp.

In E. 545 the successors of the halos and super-sickles actually prove to be decidedly hairy all round, and the numbers shed approach the numbers of halo-hairs. From evidence to be given a little later about the shedding of sickle-fibres the conclusion is drawn that the early hindrance to the growth of the lamb has resulted in the failure to shed of hairy sickle-fibres which otherwise would have shed. Nevertheless, it is apparent that the vigour of the halo-hair follicles has not been impaired. The conditions hindering the growth of the young lamb have not prevented the immediate successors of the halo-hairs from shedding. These facts from E. 545 are interpreted as additional evidence of the ability of the halo-hair follicles to resist an external factor which reduces the vigour of the follicles of sickle-fibres.

Delay in Appearance of Successors of Birthcoat Kemps.—For reasons published elsewhere, the starting to grow of a fibre is looked upon as making a big demand upon the vigour of the follicle, both in the mouse (*J. Genetics*, 1926) and in the sheep (Rudall, this *Journal*, 1934). One lamb (E. 187 of 1930, Grade 5 for halo, Valley array) had the misfortune to be weaned when only five weeks old, thereafter growing extremely badly, and eventually dying at eight months. At the standard back position the sickle-fibres all persisted. There was little hairiness in the curly-tip fibres. None of the successors of birthcoat kemps shed, and the successors were but little hairy. This lamb happened to be one chosen to have large numbers of halo-hairs marked on the back as part of the study of succession. From the search made at short intervals for the successors of these halo-hairs it was concluded that there was sometimes a delay of several weeks between the falling-out of a halo-hair and the protrusion of its successor above the surface of the skin, this delay being longer than any detected in other lambs.

SICKLE-FIBRES.

Shedding of Sickle-fibres.—For a number of reasons the shedding of hairy sickle-fibres (*i.e.*, sickle-fibres that become chalky in appearance

owing to coarse medullation soon after birth), instead of persistent growth, is thought of as an expression of follicle vigour. This same belief is applicable, as indicated earlier, to other kemps. As explained in an earlier paper, a kemp is thought to shed because the follicle works so hard that it is forced to take a rest, whereas other follicles, producing very similar fibres that never attain such an intense pitch, continue their work without interruption. The following are reasons for regarding as due to vigour the shedding of hairy sickle-fibres and allied birthcoat kemps :—

(i) This belief is consistent with the view that hairiness is an expression of vigour, in the sense that material is put out by the follicle at too great a rate to be keratinized completely by that follicle. (See this *Journal*, May, 1933, Section " Non-genetic Factors affecting the Hairiness of Curly-tip Fibres.")

(ii) The more lusty a group of fibres is before birth, the greater the average proportion shed. Placed in order in both these respects are halo-hairs, super-sickle-fibres, sickle-fibres, and curly-tip fibres.

(iii) Some evidence is derived from the shedding of sickle-fibres in lambs having different fibre-type arrays on the standard back position. At this position in lambs now to be considered the chalky hairiness of persistent birthcoat fibres is not sustained appreciably beyond the crisis level—*i.e.*, that stage at which these sickle-fibres which are to be shed complete their growth. From the comparison of the backs of different lambs and from the comparison of the back and side of the same individuals it has been concluded that if chalky hairiness is sustained down the staple clearly below the crisis-level this tends to be accompanied by less free shedding of hairy sickle-fibres. It is indeed in such a condition, with the hairiness of the big, persistent fibres exceedingly coarse, that a few halo-hairs sometimes continue to grow instead of shedding. It would appear that the sustained general vigour with which the coarser fibres of the fleece are being grown enables sickle-fibre follicles which would otherwise have been compelled to desist from production, and so shed their fibres, to maintain their activity. The data now tabulated therefore have reference only to lambs in which pronounced hairiness ceases near the crisis level of the staple. The coat was protected on the back by a cover placed in position before shedding began. The lambs figuring in this table were mostly not weighed, but they were known to grow comparatively well ; the lambs of Table 2, " Growing badly," are not included here.

TABLE 1 —SHEDDING OF HAIRY SICKLE-FIBRES

Array.	Numbers of Lambs in which		
	Majority shed.	About Equal Numbers shed and persist.	Majority persist.
Saddle and All-in—			
All hairy sickle-fibres	15	1	..
Big-ended hairy sickle-fibres ..	16	..	..
Ravine—			
All hairy sickle-fibres	4	3	6
Big-ended hairy sickle-fibres ..	4	4	5
Valley—			
All hairy sickle-fibres	7	11	5
Big-ended hairy sickle-fibres ..	9	9	5

From this table it is suggested that in arrays containing fine sickle-fibres, or fine sickle-fibres and checked curly-tip fibres, fibres which are caused to be fine by the pre-natal check, the more intense pre-natal check tends to make it more difficult for hairy sickle-fibres to shed than in arrays in which the pre-natal check produces less marked effects on fibre form. That this be so, to state the matter simply, is indeed rendered very probable by the very fact that the fine sickle-fibres are not shed.

(iv) Curly-tip fibres have only been found to shed at all freely in the Saddle (including All-in) and Plateau arrays, those arrays in which the effects of the pre-natal check are the slightest.

On the evidence that has been set out we may conclude that the shedding of hairy sickle-fibres indicates vigour on the part of the follicles. What happens if the lamb grows very badly in the early weeks? The data in Table 2 are from only small numbers of lambs, but so far as they go they are suggestive. The lambs selected as growing very poorly averaged a gain of 0·3 lb. a day over approximately their first two months, while the lambs picked out as "growing well" amongst my experimental lambs gained 0·6 lb. a day, while a few included from a stud flock grew conspicuously well. In every lamb appearing in the table the shedding situation is the same whether we consider only big-ended hairy sickle-fibres or all hairy sickle-fibres. "Wool growing badly" means that some unusual feature of growth of the kind to be mentioned under "Curly-tip fibres" was noted. As in the preceding table, records are included only from lambs in which chalkiness ceased about the crisis level. The lambs were covered on the back.

TABLE 2.—SHEDDING OF HAIRY SICKLE-FIBRES

—	Numbers of Lambs in which: Majority shed.	About Equal Numbers shed and persist.	Majority persist
Lamb growing badly, wool growing badly	..	..	7 (3 Ravine, 4 Valley)
Lamb growing badly, wool growing well	1 (Valley)	1 (Valley)	1 (Ravine)
Lamb growing well, wool growing well	7 (2 Saddle, 1 All-in, 1 Ravine, 3 Valley)	2 (1 Valley, 1 Plain)	..

It is to be mentioned that of the seven lambs growing badly with wool growing badly, in four no shed sickle-fibres at all were found on the back position. Some shed sickle-fibres have been found in all other lambs possessing, as do all those included in the tables, halo-hairs as well as hairy sickle-fibres on the back position.

The data presented suggest, therefore, that poor shedding of hairy sickle-fibres tends to accompany poor growth of the lambs in the first two months of life.

Fine Sickle-fibres.—In a small number of lambs with the array on the standard back position—Ravine, Valley, or Plain—fine sickle-fibres have been found that become somewhat coarser basally in, say, the third month, when the lamb was beginning to grow better, while other

fine sickle-fibres continue to be fine. The checked curly-tip fibres of Valley arrays have shown the same feature in lambs growing very badly indeed, when the cause of poor growth of the body is to be regarded as enhancing the effects of the pre-natal check.

Curly-tip Fibres.

In lambs growing badly the suspension of medulla formation at one time or another in the early weeks of life in persistent fibres in sickle-fibres and curly-tip fibres, chiefly the latter, for they are more numerous, has been placed on record in earlier papers. Such distributions of medulla down the staple, showing up strikingly in benzol, have been cited as conspicuous examples of the effect upon hairiness of non-genetic factors.

In regard to particular kinds of curly-tip fibres two types are to be mentioned. Firstly, checked curly-tip fibres have been dealt with in the preceding section, where it is explained that the special fineness of some fibres in the first couple of months of the lamb's life is to be attributed partly to the pre-natal check, and partly to whatever may be causing the lamb to grow so badly. Secondly, there are fibres in one lamb with the array on the standard back position Plain where there was the indication in the thickening of fibres after the age of two months that had the lamb grown normally the array would have been Valley. Here the poor growth of the lamb appears to be reflected in even those fibres that would have stood out as the coarsest curly-tip fibres in a fine-woolled animal.

As to the biggest curly-tip fibres in lambs faring badly, in body and fleece, in the autumn or winter, these fibres—peak curly-tip fibres—have been found to sustain their growth much better than other curly-tip fibres. This was so in E. 187, in which the wool grew miserably slowly in the late summer and early autumn, and in another of my experimental lambs, used by Mr. R. Waters in a study of wool-growth rate on the side, in which the coat grew very slowly indeed in part of the autumn and part of the winter.

Histerotrichs.

Amongst the lambs shown by weight records, as well as appearance to grow very poorly during their first couple of months it fortunately happened that the coats of two were dyed on the back at birth and again six weeks later. During these first six weeks it is normal for considerable numbers of new fibres, non-curly-tip fibres, or histerotrichs, to be added to the coat. In these lambs the dyeing demonstrated the unusual scarcity of histerotrichs, almost none having made their appearance during those six weeks in one of the two animals.

Summary.

This paper is based upon comparatively small numbers of lambs, for whether their poor growth resulted from bad management or ill fortune the causes were not so catastrophic as seriously to affect large numbers of animals.

Unless it be in lambs light in the extreme at birth, it is improbable that any connection exists between small birth-weight and low abundance of halo-hairs.

It is likely that the cause of poor growth of the lamb does not prevent the successors of halo-hairs from shedding—that is, from being secondary kemps.

It is probable that the following features in the development of the coat are sometimes reflections of poor growth of the young lamb:—

Marked delay in the appearance above the skin of the successors of halo-hairs.

Poor shedding of hairy sickle-fibres.

Reduction at various early stages in diameter and medullation of sickle-fibres and curly-tip fibres which would otherwise have been consistently coarser and/or more hairy from soon after birth up to the age of two months.

Failure to add normal numbers of histerotrichs to the coat.

Conclusion.

In the work on Romney wool which has from time to time been reported upon in this *Journal* somewhat more prominence has been given to the inheritance of wool characters than to the effects of environment and nutrition. The results that have now been presented emphasize the potency of non-genetic factors.

A number of features described in the development of the coat of poorly growing lambs may reasonably be regarded as brought about by unfavourable conditions, especially insufficient food in a backward spring.

The recognition of the features described was made possible by a detailed study of the developmental history of the fibre types comprising the coat of the lamb.

To breeders it may be pointed out that the lambs growing badly now reported upon mostly grew exceptionally badly. Animals making such poor progress would not be likely to be retained as breeding sheep. The present work seeks to take advantage of extreme conditions in an attempt to recognize the effects of non-genetic factors.

AGRICULTURAL LEGISLATION OF 1934-35.

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In addition to the legislation of agricultural interest reviewed in the April issue of this *Journal*, the Canterbury Agricultural College Amendment Act, the Orchard-tax Amendment Act, and special provisions contained in section 5 of the Finance Act, 1934-35, extending the powers of the New Zealand Fruit-export Control Board in relation to the export of fruit, were passed by Parliament during the 1934-35 session, which was resumed in February last.

In the following notes the legislation under notice is reviewed.

Canterbury Agricultural College Amendment Act, 1934-35.

This Act validates the action of the Board of Governors of the Canterbury Agricultural College in borrowing moneys in excess of its statutory powers to borrow by way of overdraft or on temporary loan, and confers on the Board extended power, with the consent of

the Local Government Loans Board and subject to such conditions as the latter body thinks fit to impose, to so borrow moneys, but so that the amount owing at any time shall not exceed a total of £10,000. At the same time the statute imposes on members of the Board the same liability as to illegal borrowing as that imposed by the Local Bodies' Loans Act, 1926, on members of local bodies with regard to illegal borrowing by such bodies.

ORCHARD-TAX AMENDMENT ACT, 1934–35.

This statute increases the rate of the orchard-tax imposed for general purposes from 1s. to 2s. per acre or part of an acre of the area comprised in any orchard. The proceeds of the increase in the tax shall be under the control of the Department of Scientific and Industrial Research, and shall be applied by that Department in assistance of scientific researches or experimental work in relation to the storage or transport of fruit or generally in relation to the fruit-growing industry.

FINANCE ACT, 1934–35, SECTION 5.

Section 5 of this Act authorizes the New Zealand Fruit-export Control Board to establish a special reserve fund called "The Fruit-export Guarantee Fund" out of moneys received by the Board by way of levy or in respect of the sale of fruit or received expressly for the purpose of the Guarantee Fund. The purpose of the Guarantee Fund is to enable the Board to make advances to producers to a maximum rate per case of fruit exported as fixed by the Board. Where the price realized on account of any producer is less than the total amount advanced to him out of the Guarantee Fund, the difference shall be deemed to be a loan made to the producer, and such loan shall bear interest at such rate as the Board may determine. The amount of any loan deemed to have been made to any producer may be recovered by the Board out of any surplus received on account of that producer in any subsequent year or years. The Guarantee Fund may be given as security for overdraft moneys obtained by the Board to enable it to finance the shipment of fruit under its control and intended for export.

Bloat in Cows.—This condition was the subject of inquiry during the spring months, when the trouble is most experienced. Mr Marshall, Veterinarian, Hamilton, carried out observations on its occurrence on several farms on the Waikato and Bay of Plenty Districts. It was noted that the trouble was invariably associated with an excess of white clover in the pasture and in a succulent, leafy stage. Access to water immediately after the paunch is filled with this soft clover seems to favour the occurrence of bloat. Probably for this reason bloating is frequently seen as often in the afternoon as in the early morning. The condition also received investigational inquiry at Wallaceville from an analytical viewpoint of the gas-formation in the paunch, and bacteriologically on the paunch-contents. The suggestion that the trouble might be associated with prussic-acid content of the clover does not appear to be established by investigation. Amongst preventive measures, the feeding of a small ration of dry hay in the morning, as a rule, is followed by good results. Acidulation of the drinking-water by the addition of a small quantity of dilute hydrochloric acid is spoken of as being effective, but this was not entirely borne out on inquiry.—*Director, Live-stock Division, Annual Report.*

SEASONAL NOTES.

THE FARM.

Pasture Utilization and Ensilage.

DURING November and December one of the greatest weaknesses in our pasture-management very commonly develops. This weakness lies in the production of flowering or coarse growth. Leafy pasture growth as a rule provides a highly suitable feed for milking-stock and for animals which are growing rapidly, whereas the stemmy or woody character that develops in flowering or coarse growth results in markedly poor feed for such stock. Leafy growth is characterized by a relatively high content of mineral matter which is required for the formation of milk and of bone, and a similarly high content of protein which is essential for the formation of milk and flesh. Further, leafy growth is much more digestible than stemmy growth—about 80 lb. out of each 100 lb. of the dry matter of leafy growth is digestible, whereas only from 40 lb. to 50 lb. out of each 100 lb. of the dry matter of stemmy growth is digestible. And that portion of the dry matter which is not digested is of no direct service in nutrition. Further, pastures which are allowed to become tall and stemmy in the first portion of the summer assume a relatively inactive condition during a considerable and critical portion of the producing season—*i.e.* during late summer and early autumn—whereas pastures in which the flowering stage has not been allowed to develop to any great extent tend to produce leafy feed more continuously and in greater amounts during the critical period provided the growth on them is not too short at the advent of that period

The condition of the pastures at the beginning of October suggests that this year the task of effecting the best practicable utilization of pastures will not call for attention as early as it usually does—in normal years between October and the end of the year on almost all farms devoted principally to butterfat or to fat-lamb production the effective utilization of pasture growth is likely to be an acute problem. If this problem has not been anticipated, it is at times difficult to deal with it satisfactorily, but, fortunately, if it has been anticipated suitably, then the timely taking of easy measures gives good results. On a great number of farms the key to the problem is ensilage. The work of ensilage is likely to be lightened greatly by intelligent preparation for important phases—for some of this preparation there is still ample time.

Preparation for Ensilage.

A main objective of the preparation for ensilage should be elimination of tedious avoidable labour—in this the provision of conveniently located trenches or pits is of great value. In the leading grass-farming districts there has been a significant increase during recent years in the number of trenches. This is because suitable locations for trenches, which are really modified shallow pits, can be found on most farms. Drainage is not of special moment in the sites of trenches, but naturally a really badly drained site should be avoided. Trenches usually can be made readily and cheaply with horse labour. Further, not only do they reduce the labour of handling the heavy green material, but they allow of its being compacted so well by trampling, &c., that the eventual wastage is reduced so much that it becomes virtually negligible. Full information about trenches and pits may be obtained from the officers of the Fields Division in the various districts.

Ensilage well justifies the use of labour-saving devices such as home-made or purchased sweeps and hoists. The man who undertakes ensilage without

the assistance of up-to-date equipment is a counterpart of the man who handles a large herd without the aid of the modern shed and milking-machine. This is of importance, because a substantial expansion in ensilage is distinctly advisable, and such an expansion will probably come only with the freer use of suitable equipment.

Weaknesses in Ensilage Practice.

Important faults in the making of silage may be summarized as follows :—

(1) Frequently the crop is harvested too late. This leads to unduly woody silage possessing, as to nutritive value, all the undesirable characteristics resulting from over-maturity in pasture growth. The ensiling merely preserves but does not improve the feeding-value of the material from which the silage is made. Indeed, silage as a rule is to some extent inferior in feeding-value to the green material from which it is made. Late harvesting gives less assurance of a substantial leafy aftermath, and a satisfactory aftermath frequently is of marked value during the late summer when supplies of leafy feed are likely to be scant. Further, late harvesting tends to bring about increased harm to permanent pastures because of the longer period during which shading and opening-up of the sward by the tall growth takes place.

Early ensilage is especially desirable in the case of the first cut of the season from a lucerne stand. This cut often contains a considerable number of plants invading the lucerne, and as a rule the longer such plants are left uncut the more they weaken the lucerne plants. Such plants typically are able to outgrow lucerne during cold conditions, but the increased warmth generally prevailing in the period following an early first cut enables the lucerne to outgrow them.

(2) Inadequate consolidation of the green material in pits and trenches leads to avoidable wastage following decay at the sides. It may be looked upon as practically impossible to bring about over-consolidation. The more mature and stemmy the green material the greater need for measures fitted to bring about consolidation: in this the weight of equipment and of workers can at times serve usefully.

(3) Development of excessive temperatures in the material leads finally to dark-brown or black silage instead of to the greenish to light-brown silage, which possesses more feeding-value, unless excessive wastage occurs in the liquid which may seep away from the silage. The amount of liquid that escapes from silage and the amount of loss associated with this liquid depends largely upon the amount of water originally in the green material. The seepage is apt to be greatest from silage made from material that is luscious or that is harvested in wet weather.

The high temperatures which lead to dark silage bring about not only avoidable wastage, but also substantial falling-off in value due to markedly heavy decrease in the amount of digestible protein.

(4) Inadequate or deferred covering of the stored silage with weighting material leads to avoidable surface wastage, which can be reduced by excluding the air as much as possible. The earth or other covering material should be placed on the silage practically as soon as gathering-in has been completed. Surface wastage frequently is excessive round the sides of stacks: as a means of lessening such wastage round stacks are to be preferred to ones of other shapes; the thorough consolidation of the outside during the building of the stack and the bringing of the weighting material on the top right out to the edge of the stack also assist. These means of reducing external wastage, while simple, often are ignored in the field.

Ensilage alone insufficient to ensure Effective Control of Pastures.

The most judicious action practicable relative to silage does not always give completely satisfactory control of the growth of pastures. Frequently

it proves impossible in practice to gauge exactly the area of grass required to provide the feed required by the stock. Farmers who rightly believe in good feeding prefer to have some feed to spare instead of being undesirably short of feed. Surplus feed that may arise because of such an outlook may not be sufficient to allow of its being turned satisfactorily into silage, but nevertheless it may be sufficient, if not dealt with, to bring about unsatisfactory control of the growth of pastures. When this is so it is usually advisable to check the development of coarse and stemmy parts in a field by "topping" of the pastures—*i.e.*, by mowing to remove flower-heads. Often such topping is deferred until it is possible to obtain only little, if any, benefit from it, whereas if it were carried out at the right time it would give much benefit. Indeed, if topping is carried out too near to the advent of the dry summer period which usually occurs in many districts, and if the mowing is so close that it unduly exposes the soil to drying out during fine weather, then topping may give an undesirable result. Primarily the purpose of topping is the removal of flower-stalks and coarse growth, and it should lead to the minimum mowing of leafy growth fitted for milk-production. Further, topping should be looked upon not as a routine measure, but as an emergency one necessitated by more feed than was counted upon becoming available. From this it follows that if much topping becomes advisable in a normal season, then judgment was astray earlier in the season in that enough of the grassland was not closed for hay or silage. Because of its stemmy nature, the topped growth is not of high value for milk-production, but dry stock may well be employed to consume such growth; this they do readily when it has become partly wilted. Topping that involves the mowing of tall weeds may prove of much value by reducing the shading that is readily caused by such weeds and that tends to impair pastures by opening them.

For the thoroughly efficient control of the growth of pastures in summer, ensilage and topping need usually to be associated with systematic grazing. The essential features of systematic grazing, which is not at all intricate, are: (1) Rapid grazing of fields by relatively heavy stocking—*e.g.*, from six cows an acre upwards for one to three days. (2) subsequent complete "spelling" the pastures to allow of recovery. Systematic grazing of pastures does not call for grazing severe enough to punish either the stock or the swards. Neither does it call for unusually close subdivision of farms; splendid results have been obtained on farms on which from nine to twelve fields were under grazing.

Utilization of Sheep Pastures Important.

Experience has shown that the utilization of the summer growth of pastures is as important for fat-lamb production as it is for butterfat production. Hence ensilage as a means of avoiding coarse herbage on pastures in summer, as well as of obtaining assured supplies of winter feed, could be practised with great advantage much more extensively by sheep-farmers.

Forage-crop Production.

Some aspects of the important role of forage crops was discussed in these notes last month.

Three of the main factors begetting efficiency in the growing of forage crops are of current importance. One is the use of good seed. The saving of a few pence or even several shillings an acre on seed for forage crops is almost always parsimony instead of economy, in that such saving is commonly linked with the use of seed of any or all of the following characters: Poor germination, poor vigour, poor type, or poor strain. Any one of these characters may give rise to unsatisfactory financial returns.

A second factor which widely favours the production of profitable heavy crops is liberal manuring so as to bring the fertility of the land into conformity with the full producing-capacity of the crop. While the error of

undermanuring is widespread, that of overmanuring of forage crops is practically unknown. Many seem not to realize that even in the case of the least nutritious of popular forage crops the value of a ton of the crop is more than sufficient to pay for 1 cwt. of the fertilizers commonly used with them—*e.g.*, mangels, chou moellier, and swedes are worth about 10s. a ton if hay is worth £3 a ton, and from this it follows that an increase of 2 tons an acre in the yield of these crops due to the use of 2 cwt. an acre of fertilizer would be a profitable undertaking; and in practically all districts, but especially in districts of fair to good rainfall, observation and investigation have pointed to the likelihood of much greater increases in yield being caused by suitable manuring. The third factor that contributes towards success with forage crops and probably the most important is cultivation; without good cultivation the use of good seed and liberal manuring prove, to some extent at least, futile. It is seasonable to note that the cultivation adopted in the preparation of seed-beds is often greatly below the requirements of the crop to be grown.

Lucerne.

The great value of a successful field of lucerne warrants the utmost endeavour to secure the best possible results. A fine firm seed-bed is required for fully successful establishment of lucerne. Rapid and vigorous development of the seedlings, which contributes greatly to eventual complete success, is favoured by warmth, and, because of this need of warmth, sowing during the latter part of November or in December generally gives good results. It is good practice to sow, through every coulter of the grain drill, from 12 lb. to 18 lb. an acre of seed of Marlborough origin. A greater amount of seed is needed when the seed-bed is relatively poor. Alternatively the seed may be broadcast and covered by light harrowing. As a rule, lime may be applied with advantage before the final cultivation preceding seed-sowing. Treatment of the seed with a suitable culture is advisable in order to ensure the presence of specific organisms, upon the activity of which the ultimate success of lucerne depends. Cultures supplying these organisms are obtainable at a small cost from the Department of Agriculture. Full information about obtaining and using these cultures and about the establishment and management of lucerne is contained in Bulletin 155, which is obtainable free of cost from any office of the Department of Agriculture.

Mangel-growing.

The mangel has outstanding valuable characteristics which warrant a great increase in the acreage devoted to it in New Zealand. It is particularly dependable not only because during dry seasons it fares better than most other alternative crops, but also because it is not subject to any serious disease: occasional serious losses due to a rot have been noted, but these truly are exceptional and can be avoided. The mangel yields heavily if suitably treated: yields of from 50 to 60 tons an acre are obtained over wide areas, and the crop is relatively nutritious. It is of practical importance that if not suitably treated the mangel is likely to give disappointing results. Poor preparatory cultivation may readily limit the yield of the crop

Judging from field experience, the variety Prizewinner Yellow Globe deserves its current popularity, which is based on its yield. Other varieties also, such as Red Intermediate and Golden Globe, have been giving good results. The mangel generally responds profitably to liberal manuring; a dressing of 5 cwt. an acre or more is frequently justified, and a mixture consisting principally of superphosphate and blood and bone dust in equal parts may be used with confidence. It is standard practice to sow about 6 lb. of seed an acre in rows from 26 in. to 28 in. apart, but some recent evidence suggests that somewhat closer rows may be advisable when the rainfall and the fertility favour heavy yields. Wet, cold conditions readily cause

poor strikes, and the date of sowing sometimes is too early, so that some delay in sowing to obtain warmer soil conditions is often advisable. Over wide areas November sowing is generally suitable. Between now and time of sowing, preparatory cultivation, to provide a good tilth and to maintain a loose surface layer of soil in order to minimize loss of soil-moisture by evaporation, is likely to be very valuable. The need of conserving soil-moisture as much as possible may be gauged from the fact that the equivalent of 30 in. to 40 in. of rainfall passes through the leaves of a crop yielding from 60 tons to 80 tons to the acre.

Field Carrots.

On free-working loams the field carrot is capable of heavy yields. Success generally attends sowing in November. Good results may be expected from a manurial dressing of from 3 cwt. to 5 cwt. an acre of a mixture consisting of 2 parts of superphosphate and 1 part blood and bone. Varieties which have been popular for many years are Matchless White, Barriball, White Belgian, and Guerande. Guerande, which is a very suitable variety for sheep or pigs, is grown successfully, without thinning, in rows from 21 in. to 26 in. apart, 1½ lb. of seed an acre being used. With other varieties good results frequently are obtained by hand thinning and cultivating carrots sown in rows from 21 in to 26 in. apart, but sowing in 14 in drills also gives heavy yields

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Pest and Disease Control.

DURING the forthcoming month a constant watch should be kept for the appearance of diseases, as with the advent of warmer weather a more extensive range of insect pests and fungous diseases has to be contended with. While spray applications at ten-day intervals were recommended in last month's notes, during the forthcoming period it is usual to lengthen the time between sprays. It is unwise, however, to extend the period between sprays too early in the season, and weather conditions should be the guide in this matter It is preferable to make the first three applications following blossoming at fourteen-day intervals. Subsequent sprays may be spaced three weeks apart if conditions are favourable.

For the control of brown-rot of stone-fruit lime-sulphur at 0·083 per cent plus colloidal sulphur 2 lb to 100 gallons, as mentioned in last month's notes, should be continued at three-weekly intervals.

Varieties of pears which are susceptible to black-spot should continue to receive Bordeaux 3–4 50 plus arsenate of lead 1½ lb. to 100 gallons of spray at three-weekly periods All other varieties should receive lime-sulphur at 0·1 per cent plus arsenate of lead 1½ lb. to 100 gallons.

On apples the combination given last month—viz. lime-sulphur 0·1 per cent., colloidal sulphur 2 lb plus arsenate of lead 1½ lb. to 100 gallons and 4 lb. of hydrated lime—is recommended for the next four weeks To reduce the risk of russeting on tender-skinned varieties, it may be wise to eliminate the petal-fall spray if weather conditions permit, otherwise it is advisable to apply the arsenate of lead apart from the lime-sulphur and colloidal sulphur spray.

A watch should be kept from now for the appearance of aphis, young scales, red-mite, leaf-hopper, &c., and the necessary steps should be taken for their control as early as possible. Frequently a prompt application will deal successfully with these pests, whereas one or more sprays when they have become established may fail to effect satisfactory control. One should remember that timely application is very important, as also is thoroughness of application.

Cultivation.

Cultivation should be pushed ahead as rapidly as possible in order to bring the ground to a good tilth as early as practicable. The maintenance of healthy foliage and the obtaining of good size in the growing crop is greatly assisted by frequent cultivation, especially during periods when dry conditions are experienced.

Thinning.

The thinning of the fruit crops will shortly be occupying the attention of growers. The importance of this practice in successful fruit-culture must not be lost sight of, and can hardly be over-emphasized. Too frequently thinning is looked upon by the grower as a job to be done if there is time, and often in consequence it has to give place to other work considered to be more important.

The benefits to be derived from careful and systematic thinning are as follows: Thinning and spacing of overcrowded fruit, thereby ensuring the better growth of the fruit and a more efficient spray covering; removal of diseased and blemished fruit, thus reducing the percentage of culls at harvest-time; and the elimination of under-sized fruit, thus ensuring a more uniform size in the remainder of the crop. As a result the crop is much less costly to harvest and prepare for market, and is of greater value through its improved quality.

The maturing of a well-thinned crop is much less exhausting to the tree and regularity of cropping is assisted, while the vigour and health of the tree is also maintained. No set rule-of-thumb methods can be laid down for thinning. It is customary to thin at least twice or three times during the season rather than to make a complete job at one operation. During the first thinning the aim is to lighten the load and to space the fruit by thinning the clusters. In the second and third thinnings further spacing of the fruit is attended to where necessary, and diseased and blemished fruit are removed. To secure the greatest benefit thinning should commence when each kind of fruit passes its period of natural drop. The person doing the thinning must be guided by the quantity of fruit set and the estimated ability of the tree to develop and mature a given quantity of fruit. In this experience alone is the best guide. However, it is a safe rule in thinning stone-fruit that when this work is completed no two mature fruit should be touching. This is important where brown-rot infection is experienced.

Short-stalked varieties of apples are usually thinned to singles, while with the longer-stalked kinds the clusters are thinned to two or threes, according to the crop and the vitality of the individual tree. When thinning on uncut laterals which have set fruit at practically every bud, it is wise to remove the fruit completely from every two out of three buds at least, and then thin the remaining clusters as indicated.

Fireblight.

During the coming month growers should be on the alert for the appearance of fireblight infection. Late-flowering varieties of both apples and pears should be closely watched for blossom infection. Infected blossoms become discoloured and hang on to the tree, gradually turning brown, and then black. Through fireblight being carried by bees and other insects, infection may be rapid at this stage and the loss of crop severe.

Following blossom infection the tips of the laterals may become infected. This condition is characterized by the infected tips curling and gradually turning black. Infected material should be removed and destroyed with as little delay as possible. In cases where the cause of the death of portions of the tree is not known, specimens should be submitted to the local Orchard Instructor for examination.

Grafting and Planting.

While it is advisable to have all grafting completed before this, late grafting may still be carried out, provided that the scions are kept dormant and that a branch or some low growth is left to absorb the excess of sap to prevent the "drowning" of the scions.

Scions on newly grafted trees require some attention. Where ties have been used an examination should be made to see that the ties are not cutting into the swelling scions. Where this is evident the knife should be run through the ties at the back of the graft, allowing the ties to be forced apart naturally.

To prevent damage by the blowing out of the growing scions by high winds it is advisable to tie these to some support or centre stake

Newly planted trees should receive frequent hoeings to retard weed-growth and promote fine tilth. Any unnecessary shoots which develop should be rubbed off.

Frost Protection.

In districts where heating for frost protection is carried out growers would be well advised in a year such as this, where the occurrence of late frosts is likely, not to gather in the fire-pots until late into the season.

General.

As opportunity offers an early commencement should be made on odd jobs. Where tree-bandaging with chemically treated banding materials or sacking is adopted as a supplementary means of control of codlin moth, the bands should be examined and the grubs destroyed. Breeding-places for the moth in and around the packing-sheds should also be given attention. Rough bark under which the larvæ may be located should be scraped, and cracks and crevices cleared of any grubs.

The renovation of old orchard cases should be commenced. Packing-sheds should be cleaned up and made ready for the early reception of the new season's case material.

—*R. G. Hamilton, Orchard Instructor, Hamilton.*

Citrus Notes.

Every endeavour should now be made to attend to the cultivation; ground round the trees should be worked up fine, but care should be exercised so that the feeding-roots close to the surface are not unduly damaged. A careful search should be made for evidence of bark-blotch and collar-rot, and where these are discovered prompt treatment should be given by removing all diseased bark, including a small portion of healthy bark round the edges. The wounds should then be treated by painting over with Bordeaux paste, coal tar, or the bitumen preparation called "Colas." The past few months in northern districts having been wet, lack of proper drainage will be detrimental to citrus trees and favourable to the development of collar-rot.

As the spring advances young borers become active, and their presence is indicated by the withering of the leaves on affected twigs, or, where larger limbs are attacked, by the fresh castings. In the first instance the infected twig should be removed and the grub destroyed, and in the second a few drops of benzine should be injected into the holes and then plugged with soap. When the main blossoming of lemons is finished and the greater portion of the crop has set, a spray of Bordeaux 3–4–50 should be applied as a controllant of verrucosis and grey-scab, followed by a further application to cover the extended period of flowering. If scale other than red-scale is present the trees should be sprayed with a summer oil 1–40 to 1–80 according to the brand of oil used, and if red scale is present a further spraying with oil is necessary during January and February to coincide with the hatching of the young scales. Budding can be carried out during October or early in November, or may be deferred until the bark lifts freely in the autumn.

—*I. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Parasites.

Now that the warm weather is approaching, poultry-keepers should pay extra attention to guarding against their birds becoming infested with vermin. Many chickens and young turkeys are lost each year through the ravages of parasites, especially where poultry are kept by people who are more or less uninterested, and it is regrettable that quite a number of poultry-keepers do not know the needs of their birds, and expect too much from them for the attention given. The efficient poultry-keeper does realize the importance of keeping his birds and their houses in a clean and sanitary state, just as the successful orchardist knows that it is unwise to expect any profit from his orchard if he does not do his part and keep his trees in a clean and healthy condition.

Insect pests play a very important part in the general health and productiveness of poultry, and chickens infested with vermin, whether with a hen or in a brooder, are always stunted and fall an easy prey to disease, and even if they do not become diseased they do not develop into profitable stock.

Pullets, if infested with vermin, do not grow as they should and may often fail to lay until they are nine or ten months old, and even then do not lay well. Cockerels or cock birds that are allowed to become infested with parasites are unsatisfactory as breeders, and when mated do not give good fertility. The setting hen, if troubled with vermin, may be driven from her nest or may become so thin that she will fail to effect a good hatch, and the food given her may produce looseness of the bowels.

Whenever hens or chickens appear listless, or are not thriving, although they have no definite ailment, it is well to examine them for lice, for there is nothing that is more detrimental to the health or growth of chickens than parasites, especially if they are allowed to get a foothold in large numbers.

Vermin attack poultry in different ways, and while some suck the blood, others irritate the skin by scratching with their sharp claws, while others again form crusts or scabs. The worst parasites are those that suck the blood, for the blood carries the nourishment to the different parts of the body, but if it is sucked by vermin the birds get little good from it. Those parasites that irritate the skin by crawling over and clinging to it with their sharp claws are also the cause of much trouble. These insects worry the birds day and night, giving them no rest, and the effect of the want of rest alone can well be surmised

Houses that are dark, damp, badly ventilated, and full of cracks and crevices are breeding-grounds for poultry-parasites of all kinds. Scientists who have studied the life-history and habits of these parasites have stated that the third generation of a pair of red mite may amount to 120,000, and this increase will take place in eight weeks.

The poultry-keeper must continue fighting these pests all the year round, for if he relaxes his vigilance for a while the parasites may get such a hold as to upset his plans for a whole year. All parasites may be destroyed by the use of fumes, liquids, or powders. Practically all vermin, except the red mite, can be destroyed or kept in check by dusting fine powder into the fowls' feathers, but to destroy the red mite a liquid insecticide must be used. The powder used for dusting should be dry and as fine as possible, for the finer it is the more effective it becomes. A suitable mixture for the purpose can be made up of equal parts of lime, dry earth, and sulphur. Another good method of treating birds for insects is to dip the end of a feather into nicotine sulphate and draw this under the wings or among the breast feathers. Where a large number of birds has to be treated for vermin the better plan is to place a thin line of nicotine sulphate along the top of the perches just before the birds go to roost. Before applying the

nicotine sulphate it is advisable to wipe the perches with a damp cloth in order to remove any dust, thus preventing the liquid from running off and being wasted.

Scaly-leg is caused by the scaly-leg mites (*Sarcoptes mutans*) which attack the unfeathered portion of the leg above the foot, and often the top of the toes. The minute parasite crawls under the scales of the legs and there irritates the tissues for the purpose of obtaining food with the mouth parts. As a result of this irritation small blisters appear and, after a time, rupture. The serum dries and makes a minute scab, and as the parasites become more numerous they cause a piling-up of the scab. The itching is more intense at night, and the bird, if not treated, may become weak and even die. A good treatment for this trouble is to soak the legs in soap and warm water, when the scabs can be removed, and then rub in a mixture of sulphur and lard. The treatment should be repeated in about ten days' time.

Though the ravages of parasites may cause so much loss amongst young and old poultry, if the poultry-keeper sees to it that all perches are dressed each week or so during the warm weather with waste car oil, kerosene, or some other good liquid insecticide, and if the houses are kept clean and dry and plenty of sunshine allowed into the houses, he need not be afraid of parasites driving him out of business

A Trouble with Brooder Chickens.

For several years past, about this time of the year, especially since the introduction of mass-production methods of chicken-rearing and the use of the large canopy brooders where four and five hundred chickens are reared in one lot, a number of poultry-keepers have had a trouble amongst their chickens known as green-leg, or green-wing. The first symptoms of this trouble are generally a swelling of the head or back of the neck, and on examination it will be found that the hock joints are swollen and discoloured, with the joints of the wings also often affected When the neck and head are badly affected the chicken has difficulty in breathing, and death often follows. This trouble is really caused by incorrect night conditions, overcrowding, and insufficient ventilation, thus causing many chickens to rebreathe the same impure air. Like many other chicken ailments, this trouble is much easier to prevent then to cure. The best means of preventing the trouble is not to overcrowd and to provide plenty of good, dry bedding material—in fact, it is advisable to place some fresh dry bedding material under the hover each night after the chicks are three weeks old.

Where the frame is used to brood chicks on, as recommended in this Department's Bulletin No. 66, "Utility Poultry-keeping," it is well to raise it an inch or two off the ground after the chickens are a little over three weeks old, as this allows the air to get underneath the chickens, and so helps to avoid trouble. Where the frame is not used extra care should be taken to see that plenty of fresh bedding material is used , a little extra bedding material is much less expensive than the loss of a number of chickens.

Overcrowding is one of the chief causes of trouble amongst artificially reared chickens. The writer has seen four and five hundred chickens successfully reared under one brooder, but they have been handled by experienced poultry-keepers. The beginner would be wise to place not more than half that number under each canopy brooder, and in most cases thereby obtain much more satisfactory results. Everything should be done to avoid overcrowding and anything that is likely to create a moist atmosphere. A careful watch should be kept on the chickens just as they are camping for the night to see that they do not crowd. The cockerels should be picked out as soon as they can be detected, as this allows extra room for the pullets. It is also wise to encourage the chickens to perch

as soon as they are fit to leave the brooder. Leghorn chickens should, if well brooded, be ready for perching at between six and seven weeks old, but care should be taken to see that they are gradually hardened off.

Next Season's Breeding Cockerels.

It is now a good time to secure cockerels for next season's breeding-pens. Many large poultry-farmers are pleased to sell young cockerels as soon as they can be picked out. For a small outlay one could purchase, say, two or three times the number required—as they develop the poorer birds could be culled out and sold or used for table purposes.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Swarming.

By November, if the weather conditions are favourable, swarming should be in full swing throughout the Dominion. Therefore it is most important that the beekeeper should note the condition of his hives in ample time to decide which colonies are to be allowed to swarm. Excessive swarming is often accepted by beginners as a proof of prosperity, but this cannot be regarded by any means as an established fact. Only strong colonies headed by young vigorous queens should be allowed to swarm, and in many cases it will be found that these colonies show little inclination to do so. Where a colony of moderate dimensions persists in making preparations for swarming it should be requeened from better stock at the earliest opportunity.

When a strong colony swarms, the swarm should be hived at once into a clean box, in such a manner that the bees may pass in and out of the box easily, and be left there till towards evening. By that time a hive should be prepared containing frames fitted with full sheets of foundation, and, if necessary, a feeder, the hive being placed on its permanent stand. Late in the afternoon the hive-body should be raised from the bottom-board and a clean sack laid on the alighting-board and surrounding ground. The bees should be dumped from the box on to the sack, when they will crawl into the hive.

If honey is not coming in freely, or if bad weather supervenes, the swarm must be fed with syrup prepared from sugar and water, in the proportions of one to two, so that the bees may commence comb-building at once. Excellent combs are made from sugar-syrup, and within two or three days the bees should have drawn out several combs and the queen be busily engaged filling the cells with eggs. The bees in a swarm are prepared for comb-building, and simply waste much wax if placed at once on drawn-out combs.

If the beekeeper has any reason to suspect the hive from which a swarm issues to be diseased, he should leave the swarm in the box into which he has hived it for at least three days, in order that the bees may use up the honey they have brought with them when they left the parent hive.

After the swarm has issued the parent hive should be thoroughly examined, so that the queen-cells may be removed. Every cell except two of the best should be taken away. Where the hive contains particularly good stock, and the queen-cells are large and ripe, they may be carefully preserved and placed in nuclei for the purpose of queen-raising. Very often the best queens in the apiary are procured by this means. When the swarm has been placed in its permanent hive the frames should be carefully covered by good mats. Neglect of this precaution, even for two or three days, often results in the bees building comb right into the roof, especially where gable roofs are used, thereby wasting much good material as well as making the hive difficult to open.

After-swarms.

It often happens that in spite of all precaution strong colonies throw an after-swarm within a few days of the issue of the prime swarm. Sometimes the prime swarm may be delayed by bad weather, in which case the bees may keep the virgin queens in their cells until the laying-queen has left the hive, only to liberate them immediately after, and before the apiarist has time to examine for queen-cells. These queens, being small and of quicker movement, are very difficult to detect, and may readily escape notice altogether. In this case the after-swarm may follow very quickly after the prime swarm. Occasionally, too, a few queen-cells may be missed in cutting out. If they are built, as frequently happens, on the edge of the comb against the side of the frame they are very easily overlooked

After a little observation an after-swarm can often be detected by its behaviour. A laying-queen is heavy with eggs, and usually seeks a resting-place without delay and without venturing too high from the ground. Sometimes, indeed, she falls to the earth, and the bees are unable to find her and return to the hive. However, she usually alights in some convenient spot, and the bees cluster round her with amazing rapidity. When the hives are scattered instead of being in regular rows, a beekeeper working in his apiary at a distance from a swarming hive may miss the whole operation of the issuing of a prime swarm unless the noise attracts his attention, so quickly, as a rule, do the bees settle with a laying-queen.

With one or more virgin queens in a swarm, matters are usually different. The queens are small and light, and often soar to a considerable height, choosing their own time about settling. If there are two or three queens in a swarm there are likely to be as many divisions in the cluster, so that instead of forming one compact heart-shaped mass the swarm may hang for a considerable time in several peaks Care should be taken to see that every section is shaken into the box.

A simple method of dealing with after-swarms is to place an excluder between two empty hive-bodies, the lower of which rests on the ground or a bottom-board. The swarm should be shaken on to the excluder, when the bees go through the holes in the excluder, and the queens may easily be distinguished and removed. When the queens are gone the bees return to their parent hive, and the queens may be utilized for replacing old and failing queens There need never be any doubt as to the advisability of taking every queen from an after-swarm: there inevitably is one queen left in the hive for the bees to return to.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Weed and Pest Control.

PREPARING the land for sowing and planting, and later harvesting the crops, keeps one busy most of the time, so that the recommendation to tidy up headlands and waste corners is inclined to be regarded as a counsel of perfection. However, it is beginning to be realized that this old-fashioned neatness has something more than sentiment to recommend it. Piling prunings and stumps into the base of the shelter-hedge, leaving boxes and implements on headlands and allowing weeds to grow through them make ideal conditions for the propagation of disease and pests. One has only to disturb such accumulations at any time to see the high esteem in which such conditions are held as desirable places of residence by insects and fungi of many kinds. Many of the weeds are hosts which carry over virus diseases and pests, which would otherwise die out, from

one season to another. For these reasons boxes, timber, and implements should now be stored in open sheds, and prunings and waste piled in an open space and burnt to produce wood ashes, which form a useful dressing when preparing land for cropping. It is advisable to collect also wire, stones, and anything which will prevent close mowing with a scythe towards the end of November before the weeds have commenced to seed. If this practice is continued, most annual weeds disappear and trouble from them will be greatly lessened. Very soon the growth becomes of such an innocuous character that it can, with advantage, be stacked and later dug into the soil, with cover crops, to provide humus. By planting crops suited to the conditions of land and climate and adopting clean farming methods losses from pests and disease may be reduced to a minimum. Any organisms of the kind that do appear should be studied, so that their name, habits, and appearance under all conditions are known. Then few of them will threaten serious loss, as those that are likely to do so will be anticipated and dealt with to best advantage Where identification is difficult the specimens may be forwarded by post to the Director of the Horticulture Division, Department of Agriculture, Wellington, for a report.

Weeds and grass growing on drives and yards may now be destroyed by the application of a good chemical weed-killer. The drainage will then be more effective and a good surface maintained for a longer period.

Vegetable Crops.

Towards the end of November, when berry-fruits are in good supply on the markets, also green peas and summer vegetables, it is usually advisable to discontinue pulling rhubarb and cutting asparagus, so that natural growth may be encouraged and strong crowns built up for cropping another season when those supplies are lacking. It is generally advisable to assist this growth by applying a generous dressing of manures or fertilizers now, unless it was done during the winter or spring Fowl manure is very suitable for this purpose If farm manure is used it should be in a fermented state in which all weed-seeds are destroyed. An occasional dressing of lime will benefit both of these crops, especially where the land is heavy and sulphate of ammonia has been used.

The interest in sport and natural living has increased the demand for vegetables and fruit in both a solid and liquid form Vegetable salads are being made with greater skill and are growing in popularity, while tomato juice as a beverage is recommended for everybody by leading dietists, it is certainly a very pleasant and refreshing drink. These trends are of the greatest interest to the producer, who should do the utmost to grow just what is required at the right season. There is room for a greatly increased consumption of these products, and any tendency in that direction should be supported and encouraged by the grower.

Planting the outside tomato crop is now being done. Good plants set low in well-prepared soil usually produce a fair crop. If the preparation of the land is incomplete it is unwise to rush the planting; and if plants are scarce the tendency to set out doubtful specimens should be resisted. Careful selection is necessary when pricking and planting out, when all blind and indifferent specimens should be discarded. It is better to grow a smaller area of good plants and plant spare ground with another crop.

The tomato crop in the unheated glasshouse now commences to ripen. When the surface of the ground is dry it is advisable to prune and train in the new growth and trim off and carry out and burn the lower leaves which have become exhausted. Where the land has an open subsoil and low water-level, a mulch of strawy stable manure, or just clean straw, is of assistance now in retaining moisture in the ground. Also a fortnightly application of liquid manure composed of fertilizers in solution applied after watering helps the plants to mature the crop.

The late crops, and half-hardy crops mentioned in these notes last month, may still be sown ; also swede turnips in a cool open position.

Where land infested with bad weeds has to be cleaned it should receive a shallow ploughing when the weather settles, and weeds collected by means of the harrows should be burnt as soon as they are dry. In a fairly dry season work of this kind can generally be done very satisfactorily during the summer months. The land can then be planted rather close with a winter crop at the approach of the autumn rains, or rather heavily seeded for a green crop to plough under

Small Fruits.

The harvest for fruits of this class commences with culinary gooseberries now, followed by strawberries, currants, raspberries, loganberries, Cape gooseberries, &c, filling in very satisfactorily the interval, which more or less takes place, between the seasons for the tree fruit. Distribution would no doubt be assisted if these facts were generally made known to the public. It is rather difficult for growers to realize that the majority of the consuming public know very little about fruit varieties and seasons Next to putting the fruit on the market in good condition it is necessary to let the public know the particular kind that is "in," especially as regards that which is available for only a comparatively short period.

Another demand that is becoming more insistent is for fruit-juices for drinks. Many people, so authorities tell us, do not drink enough, and pure fruit-juices are being recommended. The juice of some kinds of small fruits makes very palatable liquors, and this appears to be another instance where growers might render timely assistance by offering the service in the right way

Seasonable attention to crops includes light cultivation to destroy weeds, carefully avoiding injury to the fibrous roots which lie very near the surface In many instances a dressing of nitrate of soda when the plants are in bloom or the fruit has set assists the crops. Currants, red and white, are greatly improved by attention to summer pruning; and strawberries should be mulched with straw as soon as the first truss has set, or, in its absence, rushes between the rows and pine-needles round the plants may be used.

The Homestead Garden.

Summer bedding plants, which are now being planted, if used with moderation and good judgment are an attractive feature in the garden, and are useful for brightening up beds and borders. For open, airy positions geraniums, pelagoniums, calendulas, stocks, and antirrhinums are among the most suitable, as they thrive well under such conditions and are rarely injured by high winds. In the driest positions petunias flourish where most other plants would fail Towards the end of November, when these plants are cleared, seeds of biennials and perennials, such as wallflowers, Iceland poppies, and aquilegia, may be sown for planting out during the autumn

Most kinds of climbing-plants look their best when carefully trained, and all of them should receive this attention when young. Chiefly it consists in tying in the young growth required to cover the allotted space, and stopping surplus growth by pinching out the growing-point after a few leaves have formed In this way they become quickly established and completely cover the available space in a desirable manner. Young climbing-plants set out at the foot of a wall often suffer from lack of moisture during the summer; in dry weather they should be well watered, and a mulch of dry litter should be applied. When the roots have extended and reached moister ground they will generally be free from this danger.

Where spring flowering bulbs have to be lifted it should be done as soon as the foliage is ripe ; in the case of daffodils especially it should be done promptly, as many kinds have a very short resting-period. They should be left on the ground for a few days in a shady place to cure and then cleaned and placed in shallow boxes, securely named and stored in a cool, well-ventilated shed until planting-time.

The long, dry period last summer was the cause of considerable anxiety where a garden was concerned, especially in warm localities. Extensive plantings of karo, *Pittosporum crassifolium*, stood it well, as did most other native plants ; while many plants from South Africa thrived on it. The silver tree, *Leucadendron argenteum*, and the African lily, *Agapanthus umbellatus*, never looked better ; and the rather common *Erica pyramidalis gracilis* has excelled itself during the following winter : never has it here been so fine as regards both vigour and bloom. Freezias are giving an abundance of blossom that exceeds all past records ; and Watsonia, belladonna lilies, *Amaryllis belladonna*, Scarborough lily, *Amaryllis purpurea* (*Vallota purpurea*), and varieties of Sparaxis are in excellent condition. The experience indicates the suitability of plants of this class for localities where the summer is dry and warm and no water is available. For many plants these are evidently ideal conditions.

—*W. C. Hyde, Horticulturist, Wellington.*

In terms of section 2 of the Meat-export Control Act, 1921–22, Sir William Perry and Messrs. H. D. Acland and J. D. W Ormond have been appointed producers' representatives on the New Zealand Meat-producers Board

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WHEAT-GRAIN FOR HORSES.

J. C. D., Methven :—

Is it dangerous to feed wheat to horses, provided it is fed with discretion? Some farmers have repeatedly used it with apparent success to strengthen oat-sheaf chaff. Is it advisable to crush it?

The Live-stock Division :—

Wheat as a stock-food for any animal must be used with discretion, and this applies more especially to the horse, in which case serious gastric trouble frequently occurs through too large quantities being given at a time. It should only be given well mixed with some bulky food such as chaff, and the small allowance of wheat should be added to the chaff at each feed—not mixed in bulk—thus avoiding the risk of any of the animals getting too much. The wheat should be rolled.

COUGH IN HOGGETS.

C. V. K., Fairlie :—

Hoggets are strong and not dying, but some of them have a cough. Turnips, hay, pine needles, and rock salt are being fed. Should they be dosed, and, if so, with what?

The Live-stock Division :—

The cough amongst the hoggets is caused by the lung-worm, which is usually, if not always, associated with the stomach-worm: the method of infection is practically the same for both parasites. Dosing for stomach-worms also destroys a certain number of the lung-worm larvæ, and if the former parasite is controlled and the animal's health maintained by the suitable feeding of crushed oats and chaff, the hoggets are able to throw off the remaining lung parasites. A solution of bluestone is recommended for treating sheep for parasites. This should be made up as follows: bluestone, 1½ oz.; water, 1 gallon. Dissolve the bluestone in 1 quart of boiling water and then add water to make up to 1 gallon. Enamel or earthenware utensils should be used. The dose is as follows: lambs, 1 oz.; hoggets, 1½ oz.; sheep, 3 oz. The drenching may be repeated at three-weekly intervals.

WASTE IN CONCRETE SILO.

A. B. C., Waitemata :—

A concrete silo, 10 ft. diameter by 12 ft. high (set in the side of a small hill), is made of tongued-and-grooved blocks 2 in. thick, with iron rods outside binding them together, and three openings or doorways on the side for emptying. There is too much waste round the outside and on top: it varies from about 8 in. to 12 in. The method of weighting is with concrete blocks.

The Fields Division :—

The waste referred to in the silo is very common in straight-sided concrete silos. The waste is greater when the material is in an over-mature condition when stacked. A certain amount of waste from shrinkage at the sides appears to be inevitable in all straight-sided silos, but the percentage of waste may be reduced very considerably by keeping the material up as high as possible in the centre during building, also by tramping the sides thoroughly. A crown of at least 4 ft. should be maintained in the centre. When the silo is full the weights should go on immediately. It would be well to first put a 4 in. layer of earth on top before placing the concrete blocks. If the material to be ensiled is saved in a green succulent condition the percentage of wastage will be much smaller.

THE PROSPECTIVE TREND IN THE PIG INDUSTRY.

The increase in pig-meat production as an auxiliary to butterfat-production which was forecast last year has been fully realized, and a further substantial increase seems imminent provided the current widespread interest in improved pig husbandry is maintained and reflected in practice. The data available point to the conclusion that the Dominion's production of carcasses of porker weights now makes available for export a supply which approximates that which can be disposed of satisfactorily overseas, and, this being so, further expansion should be in the production of carcasses of baconer weights. Such a development probably would call for important adjustments in our pig-keeping, and about these adjustments that desirable type of knowledge which is based on thoroughly examined farm practice is not freely available. Hence there is urgent need for further investigation relative to several matters bearing on economic pig-production under the circumstances which seem likely to develop. This is being undertaken by the Divisions of this Department directly concerned. The following three problems are of outstanding importance: (1) The general production of pigs which provide the type of carcass suited to the needs of the prospective markets; (2) the association of good type of carcass with economical conversion of feeds into flesh—investigations already have established that there are strain variations in pigs in this respect analogous to the strain variations in dairy cows in their ability to utilize the feed provided; (3) the economical provision of feed to supplement dairy by-products when the supply of these is inadequate—this introduces crop-production and pasture-utilization problems which are being investigated by the Department. Work already done indicates clearly that a matter most acutely in need of improvement is the feeding, especially that of breeding-animals, during the period when dairy by-products are in scant supply. Until this, in conjunction with the general care of the stock, is made reasonably efficient, the considerable potential benefits from improvement of the class of pigs kept cannot be satisfactorily realized.—*Director-General of Agriculture, Annual Report.*

In rural industries, despite a prolonged adverse summer period in many districts, the volume of production has been well maintained at a point that indicates increased production capacity under normal seasonal conditions, which reflects most commendable efficiency of our farmers, when facing relatively difficult and sometimes even depressing conditions. Indeed, a close knowledge of the developments in our farming during the past five years or so suggests that the achievements in farming have reached a plane which farmers themselves a few years ago would have said could not be attained.—*Minister of Agriculture, Annual Report.*

The year was marked by the fact that record quantities of fertilizers were carried by rail. Most of the fertilizer is applied to grassland, and the increase in the quantities of fertilizers carried by rail is expected to prove valuable in maintaining the vigour and productivity of our pastures, which, certain evidence suggests, were beginning to react to the reduced top-dressing programmes of recent times.—*Minister of Agriculture, Annual Report.*

WEATHER RECORDS: SEPTEMBER, 1935.

Dominion Meteorological Office.

NOTES FOR SEPTEMBER.

AFTER a comparatively mild winter and indications of an early spring in the preceding month, the weather in September, at least during the first half, reverted to a cold and rather stormy type in most districts. Low temperatures on account of cold southerly or easterly winds prevailing, as well as extreme dryness in many parts, had the effect of retarding growth of vegetation. In the western and southern areas of the South Island conditions were particularly dry, and farmers have had to face a serious shortage of feed, with the result that there has been some loss of stock. There was also considerable mortality amongst lambs in the Gisborne, Hawke's Bay, and Marlborough Provinces owing to the cold, wet spells experienced. In most parts of the country, however, owing to a favourable winter, stock kept in good condition. In North Canterbury and Marlborough some heavy rains on the 9th relieved the situation, which had become serious owing to a prolonged period of dryness. South Canterbury did not benefit to the same extent, and good rains are badly needed in that district.

Rainfall.—Rainfall was very much above the average in the northern portion of the Auckland Peninsula, some places having more than double. The eastern districts of the North Island south of East Cape also had a considerable excess, but the remainder of the North Island received less than the normal falls. In the South Island Marlborough was the only district where more than the usual amount fell. In North Canterbury the totals closely approached the average, but all other districts experienced a very dry month.

Temperatures.—Temperatures were everywhere below the average. In the North Island the mean difference was 1·0° below; the South Island mean was 3·3° below.

Pressure Systems.—In the beginning of the month an anticyclone covered New Zealand, but the centre was situated in the south, while a cyclone was passing in the north. Consequently a cold south-easterly wind blew up the east coast, accompanied by rain and hail squalls in the area between Banks Peninsula and East Cape. Over the greater portion of the Dominion, however, fine weather prevailed, although temperatures were cold everywhere.

On the morning of the 7th another cyclone which had closely followed the track of the former was situated just west of the Auckland Peninsula, and rain developed in the Auckland Province, some heavy falls and thunderstorms occurring on the 8th. At the same time rain fell in far southern parts, but the weather was mild and pleasant over most of the Dominion. During the night of the 8th, however, the northern depression became more intense, and by the 9th rain became widespread, with many heavy falls, and southerly winds strengthened. The above-mentioned storm had passed away eastwards by the 11th, but strong southerly winds continued to blow up the east coast as far as East Cape, accompanied by frequent showers in coastal areas. Over the rest of the Dominion, however, and especially in western districts, although temperatures remained cold, the weather for the most part was fine on the 11th and 12th, and pleasant weather prevailed generally until the 15th.

On the morning of the 15th a cyclone brought rain to North Auckland. Consequently widespread rain fell in the North Island, many heavy downpours occurring, culminating in floods in North Auckland, and also in the Wairarapa on the 16th. On the 18th strong north-westerly winds blew, but rainfall was confined chiefly to the west coast districts.

From the 19th there followed a period of fine weather, but strong north-easterly winds and scattered rain occurred in the Auckland Province during the night of the 23rd and on the 24th.

Subsequently most parts of the Dominion experienced fine pleasant weather until the close of the month.

RAINFALL FOR SEPTEMBER, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	11·57	19	5·29	4·90	57·23	43·66
Russell	12·42	20	2·44	3·89	82·44	41·19
Whangarei .. .	7·40	21	2·17	4·85	70·18	49·95
Auckland ..	2·76	10	1·76	4·05	50·59	38·52
Hamilton	2·21	10	0·58	4·32	36·69	37·43
Rotorua . ..	3·24	10	0·81	4·97	54·85	41·83
Kawhia	1·41	7	0·44	4·57	..	40·75
New Plymouth ..	3·47	9	0·77	4·92	60·46	45·33
Riversdale, Inglewood ..	5·00	10	1·08	9·56	89·35	77·16
Whangamomona ..	0·74	2	0·59	7·11	62·97	56·10
Hawera .. .	2·72	10	0·88	3·42	46·25	33·53
Tairua .. .	4·15	17	1·79	4·92	61·79	50·63
Tauranga	5·36	18	1·90	4·29	51·08	40·41
Maraehako Station, Opotiki	4·47	11	1·85	4·21	57·71	41·94
Gisborne	5·32	20	1·44	2.99	38.67	37·28
Taupo . ..	2·64	9	0·54	3·82	41·81	33·12
Napier	3·20	18	0·78	1·93	42·88	24·23
Hastings	4·63	18	1·13	2·63	34·54	26·05
Whakarara Station .	3·72	10	0·82	..	52·23	..
Taihape	1·54	13	0·72	3·04	28·17	26·56
Masterton	7·06	16	2·74	3·00	35·72	29·54
Patea	2·96	12	0·97	3·59	43·82	33·03
Wanganui	1·73	7	0·65	2·87	32·10	26·72
Foxton	2·35	8	0·94	2·40	27·56	23·73
Wellington .. .	4·80	13	2·02	3·20	29·69	32·87
			South Island.			
Westport	2·70	11	1·07	8·30	66·77	70·80
Greymouth	4·75	7	0·95	8·09	71·81	73·06
Hokitika	1·71	7	0·71	9·02	82·72	82·31
Ross	2·67	6	1·59	12·43	86·89	94·81
Arthur's Pass ..	..	..	..	15·29	..	111·36
Okuru, South Westland	2·70	5	1·50	11·89	77·87	105·69
Collingwood	4·61	11	1·22	9·31	70·71	71·76
Nelson	0·76	7	0·29	3·58	34·49	28·44
Spring Creek, Blenheim	2·96	7	1·80	2·59	22·11	23·23
Seddon	3·55	7	2·34	2·14	16·38	18·76
Hanmer Springs ..	3·86	10	2·21	4·43	30·13	33·91
Highfield, Waiau ..	4·93	7	3·00	2·99	21·98	25·52
Gore Bay	3·52	5	1·74	2·94	18·56	24·25
Christchurch	1·83	9	0·95	1·93	15·77	18·92
Timaru	0·58	2	0·55	1·90	14·19	16·33
Lambrook Station, Fairlie	0·35	3	0·25	2·18	15·05	18·31
Benmore Station, Clearburn	0·21	4	0·11	1·93	15·69	17·95
Oamaru	0·63	8	0·25	1·64	14·03	16·08
Queenstown	1·37	4	0·82	2·54	23·49	21·97
Clyde	0·51	2	0·27	1·05	11·76	10·50
Dunedin	1·38	8	0·85	2·75	27·17	26·88
Wendon	0·54	3	0·45	2·42	25·13	21·69
Balclutha	1·10	4	0·83	1·89	24·40	18·16
Invercargill	1·12	9	0·30	3·24	37·16	33·02
Puysegur Point ..	4·14	11	1·33	6·36	65·00	61·71
Half-moon Bay ..	1·55	10	0·64	5·02	43·33	42·94

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THE LIME-REQUIREMENTS OF SHEEP.*

THE LIMITATIONS OF OUR KNOWLEDGE.

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MUCH work has been done during the last ten or twenty years on the mineral-requirements of farm animals, and it is well that stock should be taken of our knowledge from time to time in an endeavour to obtain a true perspective of the progress which any advances provide. This paper is restricted to a discussion of the lime-requirements of sheep.

Both to the research worker and to those who are to-day interested in applying the results of research work many questions will occur. It may be asked, "What progress has been made during the last fifty years concerning knowledge of the functions of lime in the animal body?" The reply would be, "Not very much" Or it may be asked, "Just how much lime should a sheep receive in its food per day, per week, or over the whole year?" One must answer, "It is not known." Or, finally, it may be asked, "Will it ever be possible to state definitely the quantities which should be present in the food of the animal?" And to this the answer is, "It is doubtful if the answer will ever be known." Among those interested in the research side of nutritional problems there may be some who will disagree with these views, but evidence will be produced to show that there are grounds for the pessimistic line of thought suggested.

PROGRESS DURING THE LAST FIFTY YEARS IN KNOWLEDGE OF THE FUNCTIONS OF LIME IN THE ANIMAL.

In dealing with any nutritional problem information obtained on one species of animal is often just as applicable to an entirely different species. One is therefore justified in discussing such problems from a wide angle. Many notable contributions have been made during recent years regarding the part played by lime in the animal economy. Many of these advances have been made by the medical sciences working hand in hand with the chemist, the physiologist, the histologist, the nutritionist, and with others. Their work has shown the important status of lime as an essential element of the body. But even to-day much of the knowledge is imperfect and incomplete, even in the minds of those whose researches have qualified them to speak with authority. The remark

* Substance of a paper presented at the conference of the New Zealand Grassland Association at Christchurch, August, 1935.

of a leading medical man writing on the use of calcium as a therapeutic agent sums up rather aptly the present position of knowledge in regard to the whole question of lime in animal nutrition when he said, "The present use of calcium is, in many instances, the introduction of an agent of which the physician knows little into a body of which he knows less in entire forgetfulness of the universal rule that any agent capable of doing good is capable, if improperly used, of doing harm." And so it is in regard to the nutritional requirements of farm animals. It is known that lime is necessary for bone-formation, membrane permeability, heart-action, the coagulation of blood and milk, nerve and muscle excitability, and the maintenance of the acid-base equilibrium in the blood, but the manner in which it acts in many of these cases, just how indispensable it is, and the optimum and minimum levels are still exceedingly obscure. It is known also that, associated with certain diseases or nutritional disorders, there may be an increase or a decrease in the level of the calcium in the blood, and that cures of these complaints are associated with a return of the blood calcium to normal, but the mechanisms whereby these changes take place, in many cases, still await a solution.

MILK-FEVER IN EWES AND COWS.

One well-known example is the case of milk-fever in ewes and cows. It has been established that this is invariably accompanied by a fall of the blood calcium from a normal value of about 10 mg per 100 c.c. of blood serum down to levels as low as 2 mg. per 100 c.c. The records of 127 cases investigated at Canterbury Agricultural College last year were as follows :—

15	milk-fever cases	7·0–8·0	mg. calcium per 100 c.c blood serum.
16	,,	6·0–7·0	,,
31	,,	5·0–6·0	,,
35	,,	4·0–5·0	,,
22	,,	3·0–4·0	,,
8	,,	2·0–3·0	,,

Many of the animals from which these samples were collected responded to udder-inflation, while others did not recover. Mr. A. Leslie (1934) of the Veterinary Department of Canterbury Agricultural College, who carried out the veterinary side of the work, has classified these milk-fever cases into three groups :—

(1) Poorly-nourished ewes suddenly put on to a green diet and not started to form milk ;
(2) Well-fed and well-nourished ewes (apparently high producers) and forming milk ; and
(3) Poorly-nourished ewes commencing to form milk.

All types showed a subnormal blood calcium, but knowledge of the level of the calcium in the blood does not offer a clear solution of the cause of the trouble. Milk-fever has been called "the disease of theories." Numerous theories have been put forward since the time when Schmidt, believing it to be of bacterial origin, stumbled on the udder-inflation method in 1897, or at least suggested a method of treatment which by a happy accident led to the adoption of the udder-inflation method, and by its use reduced the mortality rate considerably. And although to-day these various theories have been disproved or rejected

the true etiology of the disease still awaits solution. It can be stated fairly definitely that this decrease in the calcium in the blood is due to a disfunctioning of certain of the glands of the endocrine system—*e.g.*, the parathyroid glands—but whether other glands are also concerned and just what are the mechanisms involved are not known. Determination of the blood calcium is invaluable as a diagnostic aid, but that is all that can be said for it.

Following on the discovery by Little and Wright (1925) and Dryerre and Greig (1925) in England that in milk-fever cases there was a lowering of the blood calcium there were many who suggested that this disease must be associated with, or the result of, a deficiency of lime in the diet of such animals, but an examination of practical and experimental data cannot support this claim. Cows, even on the richest of pasture, have been known to suffer from an attack of milk-fever. True these are often the heaviest milkers, but, as Annett (1931) pointed out very clearly at the meeting of the New Zealand Grassland Association in 1931, it is very difficult to believe that on intensively managed pasture they are not receiving sufficient lime in their food to satisfy their requirements if digestive and other bodily functions are normal. Further, it has been shown that cows can produce for months on a diet which is supplying only a half, or even less than a half, of the lime that is being removed daily in the milk. This is well illustrated by the work of Groenewald (1935) at Onderstepoort, who has published recently data for cows kept on an exceptionally low-lime diet for two lactation periods Such a drain of minerals must, of course, be serious, but these and similar experiments emphasize the high powers of adaptability possessed by the animal—in periods of shortage it can draw on its reserves, in periods of plenty these can be built up again. Under these conditions of lime-imbalance milk-fever need not occur. In fact it is doubtful if it is much more frequent than when the diet is perfectly adequate, as judged by our present-day nutritional standards for stock. The same remarks must apply to milk-fever in ewes, except, perhaps, in those cases where information collected by Leslie suggests that a low plane of nutrition can be a predisposing factor in the incidence of the disease. It would appear, therefore, that it will be necessary to look elsewhere than to the lime-content of the diet for the true explanation of the cause of milk-fever in farm animals.

If further proof is required for the justification of the views expressed it is supplied by an experiment commenced nearly four years ago by the author at Cambridge University. Several ewes were placed on a diet which was particularly low in lime and were kept on this carefully controlled diet, consisting of hay and flaked maize, for two and a quarter years. They were receiving about 1·5 grammes of lime (CaO) per day (a pasture containing 0·5 per cent. of lime would have supplied to the ewes, which averaged 150 lb. live-weight, approximately 12·4 grammes per day, a 700-per-cent. increase) and yet none died with symptoms identical with those usually associated with milk-fever. Some did die, but as a result of some other causes—*e.g.*, in two cases from a pregnancy toxæmia and in another case through death of twin lambs in utero shortly before lambing. Three were able to rear their lambs. The number of ewes worked with—nine—was rather small to allow very definite

conclusions to be drawn, but on that abnormally low-lime diet one would have expected some of them to be affected by definite milk-fever symptoms if milk-fever can be the direct result of a lime-deficiency in the diet.

MAIROA DISEASE.

The experiment just mentioned was not undertaken with the sole purpose of investigating the cause of milk-fever in ewes. At that time Mairoa disease in New Zealand was considered by some to be due to a deficiency of lime in the pasture. Aston (1928) had found that the pasture in those areas where the disease occurred contained percentages of lime (CaO) as low as 0·59 per cent. On such pastures ewes averaging 130 lb. would receive 10·8 grammes of lime (CaO) per day, over six times as much as the animals used in the Cambridge experiments, so that it was felt that if a serious lime-deficiency was the cause of the trouble, which Aston credited to lack of lime, then these animals should probably suffer from it after several months on this deficient diet. That they did not do so was regarded as evidence that the cause of Mairoa disease was not due to a deficiency of lime in the pasture. Additional support for this view is provided by the fact that in Canterbury sheep are reared, and reared successfully, on pastures which show as low a lime-content as the Mairoa pastures.

In a discussion of the possibility of a deficiency of lime being present in the ration of sheep fed entirely, or almost entirely, on grass the following information may be of interest. The two classes of sheep which will require the greatest quantity of lime in their food will be the milking-ewe and the young growing lamb or hogget. Woodman (1933) says that ewes suckling lambs give 2½ gallons to 3½ gallons of milk per week. The latter figure may be too high for certain breeds, but if it is taken as the maximum yield it is interesting to compare the lime output in this with the ewe's lime intake from her food. During this time of the year the ewes will be consuming grass, and here in Canterbury a reasonable estimate of the lime-content should be an average of, say, November–March. At Canterbury Agricultural College this has been found to equal 0·72 per cent.

DATA FOR A EWE WEIGHING 120 LB. LIVE-WEIGHT.

Milk-yield per Week.	Lime in Milk per Week.	Food consumed per Week.	Lime in Food.
3½ gallons ..	0·077 lb.=4·99 grammes per day	27 lb.	0·194 lb.= 12·6 grammes per day.

Even when due allowance is made for functions of lime, other than milk requirements, and a low degree of utilization it is difficult to reconcile such figures with any theory postulating a shortage of lime in the diet—and this is at a period of the year when the ewe would be expected to require maximum amounts.

Furthermore, a young lamb which has been reared under good conditions will be 70 lb. to 80 lb. live-weight at four months when it is weaned, say, in December or January. By the following January it

would probably have increased its weight under Canterbury conditions to about 100 lb. to 120 lb., an increase of about 20 lb. to 50 lb. Slaughter trials have shown that a sheep (fasted live-weight) will contain in its body from 1·18 per cent. to 1·32 per cent. of lime according to its condition. Consequently the maximum storage of lime should not exceed 0·66 lb. during approximately twelve months, or an average of 0·0018 lb. (0·82 grammes) per day. Again it is difficult to believe that there could be in our New Zealand pastures insufficient lime to satisfy the above demands, under even the most diversified conditions.

In regard to various bone diseases considerable progress has been made. The etiology of rickets, osteomalacia, osteoporosis, and allied disorders have been investigated fairly completely. In view of the fact that they are associated with defective mineralization in the body they may be mentioned, but it is scarcely within the province of this paper to deal with them in any detail.

Vitamin D should, perhaps, also be mentioned since it plays such an important part in the metabolism of calcium in the body. The chemical nature of this substance has been successfully elucidated during recent years, but the exact way in which its influence is exerted in the animal-body is not yet fully understood.

Sufficient has been said, however, to show that in regard to the first question raised earlier in the paper—namely, "What progress has been made during the last fifty years concerning knowledge of the functions of lime in the body?"—many difficult points await solution.

Much progress has been made; much more requires to be made.

What are the Daily Lime-requirements in the Feed of a Sheep?

The question includes the words "in the feed." A fairly accurate estimate can be made, of course, of the approximate amounts of lime required to be stored by the animal at various stages of growth. Using data which Henry and Morrison (1928) quote from slaughter experiments the following table of lime storage could be constructed to represent maximum storage rates for lime:—

Weight. lb.	Lime (CaO) stored in Body. lb. (approximately).
10	0·132
50	0·660
100	1·320
150	1·980

and then in the case of pregnant ewes further additions could be made for the developing lamb. This would be found to increase with the age of the fœtal lamb. Bass (1923) gives the following figures as the absorption of calcium by the fœtus in the human being:—

0·0048 gramme daily up to the 120th day of pregnancy.		
0·083	,,	120th to 150th day of pregnancy.
0·087	,,	150th to 180th ,,
0·084	,,	180th to 210th ,,
0·638	,,	210th to 270th ,,

A somewhat similar relationship should hold for ewes, the fœtal demand for lime increasing as bone-formation became fairly rapid during the latter months of the gestation period.

And finally the quantity of lime in the milk can be calculated with a fair degree of accuracy. Sufficient work has been carried out to give an approximate idea of how much milk is secreted by a ewe while suckling her lamb. The percentage of lime in this remains fairly uniform under the most diverse conditions, so that the average daily or weekly output in the milk can be calculated. Pröscher (1914) found that ewe's milk contains 0·271 per cent. lime (CaO), Abderhalden (1914), 0·245 per cent. Shearer and Stewart (1931), in a comparison of the milk of ewes on poor hill pasture in Northumberland with that of a similar flock receiving a mineral supplement, obtained 0·215 per cent. and 0·224 per cent. respectively. The lime-deficient ewes at Cambridge yielded milk varying from 0·200 per cent. to 0·299 per cent. of lime (CaO).

All this data will give the total quantities of lime which must be removed from the diet of the animal (excluding that excreted in the urine—a very small amount; and that excreted through the large intestine into the fæces and voided with it—a varying amount which may be quite large at times) but is no index of the amount which must be present in the food. It would be necessary to know the digestibility or availability of the lime in the food in order to determine this. It would probably be possible to find this out with a reasonable degree of accuracy if rations were absolutely standardized, if the percentage of fibre was always the same, if the lignification had proceeded to the same degree, if mineral ratios did not vary, and so on. Such, however, is not the case in practice and can never hope to be so that it is not necessary to follow such a train of thought further.

One does not have to work for any length of time on mineral-metabolism studies in order to find vastly different storage rates under a level of food intake which remains fairly constant. It is evident that there must be a multiplicity of factors which will account for this. This is amply borne out by the following storage rates of some of the animals experimented with at Cambridge :—

LIME BALANCES DURING FOURTEEN-DAY PERIODS.

Period.	Wether.	Food Intake.	Stored.
		Grammes.	Grammes.
1	1	25·38	−5·05
2	..	25·57	−2·52
3	..	24·80	+0·17
1	2	23·86	−9·10
2	..	25·10	−3·85
3	..	24·96	−2·07
6	1	6·34	−3·35
7	2	7·07	−0·47
9	..	7·31	−7·23

It is sometimes possible to explain differences such as those shown by the two animals in the above table, but more frequently a correct

interpretation of the data is not possible. The large fluctuations in the fortnightly balances with the above animals were undoubtedly due partly to the fact that they were on an abnormally low diet.

In some experiments that were carried out at Canterbury Agricultural College last year with mature wethers, which were receiving a much larger food intake of lime, these discrepancies were still observed.

LIME BALANCES DURING TWELVE-DAY PERIODS.

Period.	Wether.	Food Intake.	Stored.
		Grammes.	Grammes.
1	23	129·8	+15·5
	348	127·4	+ 4·9
	468	148·5	+22·8
	48	148·5	+16·1
2	23	145·2	− 2·5
	348	114·8	− 4·8
	468	162·4	− 2·8
	48	168·0	+ 3·6

WILL IT EVER BE POSSIBLE TO STATE DEFINITELY THE QUANTITIES WHICH SHOULD BE PRESENT IN THE FOOD OF THE ANIMAL?

Such factors as the availability of the minerals in different types of feed, the effect of alteration of the mineral ratios, variations in the vitamin D content of the food, and other factors influencing absorption in the alimentary canal, the change in the requirement of the animal at different times of the year, and variations which are the result of certain idiosyncracies peculiar to individual animals must preclude the hope that our knowledge of the subject can ever be a very exact one.

It is necessary only to consider the data given by different authorities for the requirement of farm animals in order to realize their inability to agree on definite standards. Take, for example, the milking-cow. Based on Kellner's standard—namely, 32·5 grammes calcium per 1,000 lb. live-weight and 0·87 grammes calcium per pound of milk—the requirements per gallon of milk are :—

Maintenance, plus 1 gallon	..	41·2 grammes calcium.
,, ,, 2 gallons	..	49·9 ,,
,, ,, 3 ,,	..	58·6 ,,
,, ,, 4 ,,	..	67·3 ,,
,, ,, 5 ,,	..	76·0 ,,

These figures of Kellner imply a utilization of 62 per cent. of the food calcium for milk-formation. Crichton (1930), however, says that on an ordinary ration an assimilation of 15 per cent. to 20 per cent.

of the mineral matter may be expected. Assuming that only 20 per cent. of the food calcium is assimilated, then the requirements for a 1,000 lb. cow would be :—

Maintenance, plus 1 gallon	..	59·4 grammes calcium.
,, ,, 2 gallons	..	86·3 ,,
,, ,, 3 ,,	..	113·2 ,,
,, ,, 4 ,,	..	140·1 ,,
,, ,, 5 ,,	..	167·0 ,,

Kellner's figures are considerably lower than those given by Crichton, which emphasizes the uncertainty of our knowledge of the mineral requirements for such a well-known substance as lime, and in view of the wide range in the quality of the grass, hay, silage, and various supplementary crops other than grass such differences as those in the above table will always be encountered.

Another factor which must be remembered in any attempt to draw up definite dietary standards is the remarkable degree of adaptability possessed by animals. The experimental sheep used at Cambridge showed this to a marked degree. Young growing wethers placed on the same low-lime diet as the ewes which have already been mentioned were subjected to metabolism studies. Although their food intake was well below the usually accepted dietary standards they soon adjusted their lime balances and even managed to store a small amount. A further reduction in the lime in the food-supply once more threw the animals on to a negative lime balance, but this was again adjusted by the animals to a positive one. This will be clear from the data in the following table :—

LIME BALANCES.

Period.	Daily Food-supply.	Mean Daily Balance.	Period.	Daily Food-supply.	Mean Daily Balance.
	Lamb No. 1.			*Lamb No. 2.*	
	Grammes.	Grammes.		Grammes.	Grammes.
1 ..	1·81	−0·36	1 ..	1·70	−0·65
2 ..	1·82	−0·18	2 ..	1·79	−0·27
3 ..	1·77	+0·01	3 ..	1·78	−0·15
4 ..	1·29	−0·03	4 ..	1·10	−0·21
5 ..	1·05	+0·09	5 ..	1·30	+0·05
6 ..	0·45	−0·24	6 ..	0·34	−0·35
	Lamb No. 3.			*Lamb No. 4.*	
	Grammes.	Grammes.		Grammes.	Grammes.
1 ..	0·71	−0·24	1 ..	1·21	−0·24
2 ..	0·67	−0·14	2 ..	1·15	−0·25
3 ..	0·97	−0·18	3 ..	1·27	−0·08
4 ..	0·77	+0·12	4 ..	1·17	+0·04

NOTE.—Each period lasted for fourteen days.

It should be obvious, therefore, that it is difficult, if not impossible, to make any statement regarding definite requirements for farm animals.

The Approximate Assessment of Lime-requirements.

If the above statements and assumptions are correct, the question naturally arises "What standards should be adopted for farm animals?"

It has been made adequately clear that this will not be a fixed amount—milking ewes will require more than dry sheep, young growing lambs more than mature ones, and so on. In practice possibly the safest recommendation that could be made would be to calculate the amount stored in the body, or utilized in milk-formation, &c., and assume a 30-per-cent. to 60-per-cent. utilization of the lime in the food and then calculate the quantity which would require to be present in the food to satisfy this demand. The percentage utilization (30 per cent. to 60 per cent.) will depend upon such factors as (1) nature of foodstuff—*e.g.*, young grass is much more digestible than more mature material; (2) nature for which required—*e.g.*, the data obtained by various research workers suggests that lactating animals utilize the minerals in their food more efficiently than non-lactating animals.

Despite the large volume of information which is available on the lime-requirement of farm animals the mass of experimental material which has been collected by the different Research Institutions, and a certain amount of theorizing on the subject, it is not possible yet to draw up a definite set of feed-requirements for sheep under various dietary conditions. The view has been taken in this paper that this will not be possible, and reasons for this have been given.

Under those conditions where supplementary feeding is practised fairly extensively the shortage of lime in certain feeds may, of course, become serious and the addition of lime supplements may not only be advisable, but may even be necessary if success is to be achieved. The remarks in this paper, however, are written more from a grassland point of view for those localities where the major portion of the animals' requirements are derived throughout the year from grass. The subject of supplementary feeding would increase the scope of this paper too much, and it is not proposed to deal with it here.

Cases of rickets have been known to occur among sheep brought from poor country on to better pastures, or sometimes among stud sheep which are being reared on a high plane of nutrition. The observations made in this paper might suggest that this trouble should not occur under conditions where the animals are placed on pasture which has a moderately high lime-content. In the case of sheep, however, brought from hard country on to better-quality pastures the sudden stimulation to extra growth may induce an unbalanced set of conditions in which mineralization does not keep pace with the other growth processes taking place in the body, and rickets may result. In the case of the other example—namely, stud sheep which are living on a high plane of nutrition—a somewhat similar state of affairs exists. These are, perhaps, special cases where the use of a mineral supplement may be necessary.

The somewhat pessimistic line of thought adopted has been prompted by many frequently asking if mineral supplements should be fed to

sheep. Often the sheep are doing well without them, the lambing percentages are good, and very little trouble of any kind is being experienced with the flock.

The view has been taken in this paper that the mineral side of animal nutrition has been overemphasized in certain cases. The feed-intake may be insufficient to satisfy the demands of the animal at certain stages in its life—for example, the poorer types of pasture during the height of lactation—but the drain of lime from the bone reserves at this time can, under average conditions, be built up again during the non-lactating and non-pregnant period. In this paper an endeavour has been made to present a truer perspective of the position in regard to certain aspects of the lime-requirements of sheep. It has, of course, been possible to deal with only a few of the major points which discussion of such a subject should suggest.

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SWEDE AND TURNIP VARIETIES.

THEIR DESCRIPTION AND DISTRIBUTION IN NEW ZEALAND.

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(Concluded.)

YELLOW FLESHED-GREEN TOP (NETTED).

Varieties: Romney Marsh, Centenary.

Foliage green with slight tinge of purple. Mid-rib and stalk green, but in a few cases purple at base. Crown rounded. Shoulders rounded. Root globe-shaped, with a tendency to taper. Skin colour above ground-level, green; below, yellow. Skin-texture netted. Flesh yellow and moderately firm.

For all practical purposes these varieties may be regarded as synonymous, the bulk of the seed being sold as Romney Marsh. They are by no means extensively grown and are not regarded as being as hardy as the Aberdeens.

Table 3.—The Distribution of Yellow-fleshed Turnip Varieties in New Zealand stated as the Acreage in each District and as a Percentage of the Area in Yellow-fleshed Turnips in each District, with a Summary for all New Zealand.

Area devoted to	East and West Southland, Mid and South Otago	Central and North Otago, South Canterbury	Mid and North Canterbury *	Marlborough and Nelson	Manawatu and Wanganui	South and North Taranaki	Wairarapa, Hawke's Bay, and Poverty Bay	Waikato, King-country, and Central Plateau	North and South Auckland, Bay of Plenty.	All New Zealand.
All varieties—Acreage	47,000	10,450	7,450	700	1,700	2,200	500	1,650	1,500	73,550
Purple Top Yellow Aberdeen—										
Percentage	35·5	37·1	25·03	35·7	37·9	19·9	55·4	45·3	57·8	34·9
Acreage	16,830	3,883	1,665	250	645	437	278	747·5	868	25,603·5
Waites Eclipse—										
Percentage	13·2	3·8	†	2·1	†	..	..	..	..	9·4
Acreage	6,399	400	52·5	15	15	..	..	..	..	6,881·5
Bruce—										
Percentage	8·1	†	†	..	..	..	†	..	..	5·4
Acreage	3,849	36	112·5	..	..	..	3	..	..	4,000·5
Green Top Yellow Aberdeen—										
Percentage	25·2	33·7	30·3	55·0	37·0	24·6	27·0	44·7	38·9	28·2
Acreage	11,940	3,528	2,257	385	645	542	135	737·5	594	20,764·0
Fosterton Hybrid—										
Percentage	2·8	8·7	20·3	3·0	†	..	..	..	†	5·2
Acreage	1,357·5	913	1,512·5	21	15	..	..	..	6	3,825
Dales Hybrid—										
Percentage	2·1	3·1	3·1	..	..	..	..	..	..	2·1
Acreage	984	328·5	235	..	..	..	..	..	..	1,547·5
Wallace—										
Percentage	†	..	..	..	..	..	..	..	..	0·6
Acreage	436·5	..	..	..	..	..	..	..	..	436·5
Romney Marsh—										
Percentage	3·4	2·4	†	..	†	37·7	3·0	†	†	4·0
Acreage	1,656	251·5	112·5	..	20	831	15	31	12	2,929·0
Centenary—										
Percentage	†	..	†	..	..	8·5	14·0	..	†	1·1
Acreage	436·5	..	112·5	..	..	188·5	70	..	20	827·5
Yellow Tankard—										
Percentage	..	..	..	..	..	2·8	..	..	..	0·08
Acreage	..	..	..	..	..	57·5	..	..	..	57·5

* Of Mid-Canterbury acreage 10 per cent. is Webb's Renown. † Under 2 per cent. of the area of the district.

YELLOW FLESHED-YELLOW TOP GROUP.

Variety: Yellow Tankard.

Foliage green, mottled with red; mid-rib and stalks green, occasionally tinged with reddish-purple at base. Crown rounded. Shoulders rounded. Root tankard-shaped. Skin colour above and below ground-level a pale yellow or deep cream; texture smooth. Flesh yellow, moderately firm, no discoloration.

The group is of little commercial importance.

In Table 3 the distribution of the more important varieties is given in tabular form as a percentage of the area in yellow-fleshed turnips in each district, with a summary for all New Zealand. The figures are, of course, approximate, more particularly in view of the fact that many growers mix varieties together before sowing.

WHITE FLESHED TURNIPS

Varieties may be grouped most conveniently as follows:-

- Purple Top: Purple Top Mammoth.
- Green Top: Imperial Green Globe, Hardy Green Globe.
- Red Top; Red Paragon, Lincolnshire Red Globe.
- White Top: Early Six Weeks, Whitestone Stubble, Pomeranian White Globe.
- Mottled Top: Devonshire Greystone.

White-fleshed turnips occupy an area approximately three times that of yellow-fleshed turnips. They are most extensively grown in Canterbury, where the acreage of 83,000 is more than half that devoted to white-fleshed turnips in the Dominion.

The main characteristics desired in white-fleshed turnips are early maturity and keeping quality. As the earliest varieties are the poorest keepers it is frequently necessary to sacrifice one character for the other or to grow varieties of different maturity so that they will be available as required. Hence the difference between one group and another is chiefly a matter of maturity and keeping-qualities.

The White Top group may be regarded as the earliest (Fig. 11). They are virtually not grown in New Zealand. Purple Top Mammoth (Fig. 8*b*) is the standard early variety and occupies about 11 per cent., or 17,000 acres, of the total 159,000 acres of white-fleshed turnips grown. Devonshire Greystone (Fig. 8*a*) is of about the same maturity as Purple Top Mammoth, but is not popular, occupying only about 2·6 per cent. of the acreage.

Red Paragon and Lincolnshire Red Globe (Fig. 10) may be regarded as synonyms, and follow close behind Purple Top Mammoth, occupying about 13 per cent. of the total. They are slightly later than Purple Top Mammoth.

Hardy Green Globe and Imperial Green Globe (Fig. 9) are the latest varieties and by far the most important. They may for all practical purposes be regarded as synonyms, and together occupy nearly 70 per cent., or 109,200 acres, of the total 159,000 acres. They combine better than any other the desired characteristics of excellent keeping-quality and reasonably early maturity for they are in comparison with yellow-fleshed varieties extremely quick growers.

WHITE FLESHED - PURPLE TOP GROUP.

Variety: Purple Top Mammoth. (Fig. 8*b*).

Foliage green, splotched with purple, stalks and mid-rib purple. Crown flat to round. Shoulders rounded. Root globe-shaped. Skin above ground dark purple, due to an association of red with green; green colour may be observed generally as an uneven band at ground-level, but if not apparent here can be discerned in the underlying tissue if a

FIG. 8.

a Devonshire Greystone; *b* Purple Top Mammoth

thin layer of outer skin be scraped away. Lower portion of bulb white, but may be tinged with red. Skin-texture smooth Flesh white. Maturity early.

A small percentage may be found which are red in colour with no green band and no underlying green colour, and are therefore not purples, but reds.

WHITE FLESHED - GREEN TOP GROUP.

Varieties: Imperial Green Globe (Fig. 9*a*), Hardy Green Globe (Fig. 9*b*).

Foliage green; stalk and mid-rib green, though base of stalk and leaf scars may be tinged occasionally with purple. Crown rounded.

Shoulders rounded. Root globe-shaped; there is a tendency for Hardy Green Globe to show greater variation in shape than Imperial Green Globe and to consist of a larger proportion of oval-shaped bulbs. Skin green above ground, white below; texture smooth. Flesh white. Maturity later than the other varieties of white fleshed turnips recorded.

FIG. 9.
a Imperial Green Globe; *b* Hardy Green Globe.

WHITE FLESHED-RED TOP GROUP.

Varieties: Lincolnshire Red Globe (Fig. 10*b*), Red Paragon (Fig. 10*a*).

Foliage green with a red mottling, which becomes more evident towards maturity; stalks and mid-rib red. Crown flat to round. Shoulders rounded to square. Root globe-shaped; Lincolnshire Red is slightly more oval than Red Paragon. Skin above ground bright red in colour without the underlying green of Purple Top Mammoth; below ground white, occasionally tinged with red; texture smooth. Flesh white. Maturity, second early.

Occasional Purple Tops, with or without green band, but always with green underlying, are to be found and are not true reds.

WHITE FLESHED - WHITE (CREAM) TOP GROUP.

Varieties : Early Six Weeks (Fig. 11*b*), Whitestone Stubble (Fig. 11*a*), Pomeranian White Globe (Fig 11*c*).

Foliage green, mid-rib and stalks green, but frequently tinged with a reddish-purple colour at base. In early Six Weeks and Whitestone

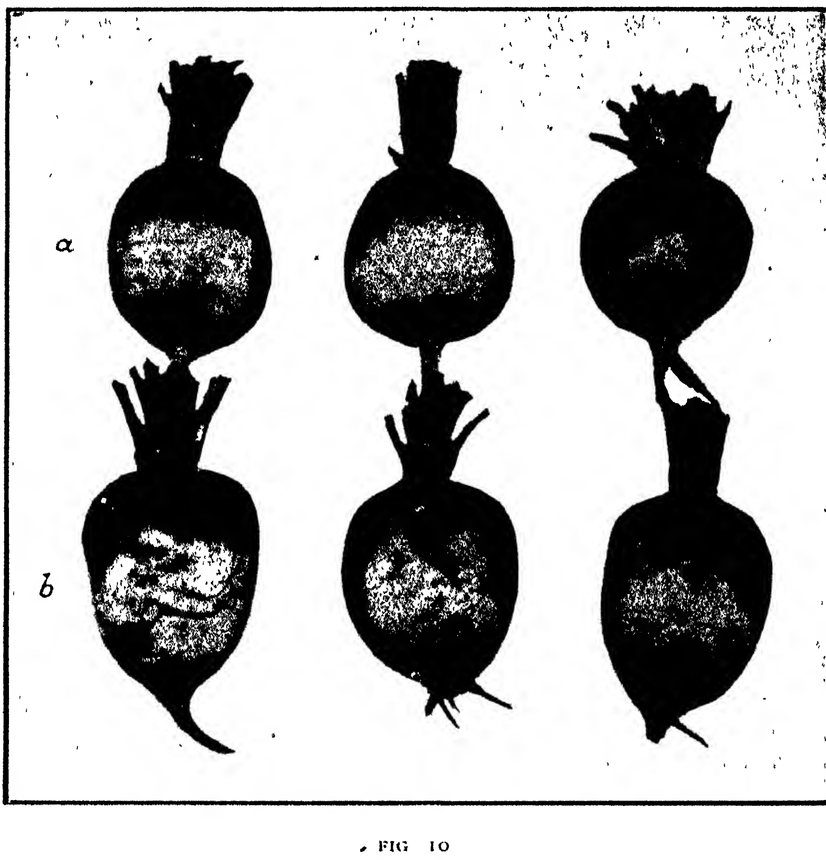


FIG 10

a Red Paragon, *b* Lincolnshire Red Globe

Stubble the crown is flat or sunken, but in Pomeranian White Globe it is rounded. Shoulders rounded to square in Early Six Weeks and Whitestone Stubble; rounded in Pomeranian White Globe. Root, Early Six Weeks and Whitestone Stubble are flat, whereas Pomeranian White Globe is globe-shaped; whole surface creamy-white in colour and very smooth in texture. Flesh white. Maturity, first early.

WHITE FLESHED - GREYSTONE GROUP.

Variety : Devonshire Greystone (Fig. 8*a*).

Foliage green with some red mottling ; mid-rib and stalks variegated red and green, chiefly red. Crown flat to round. Shoulders rounded to square. Root globe-shaped. Skin colour varies, presenting the following types : 1, green tops ; 2, purple tops, with or without the green band ; and 3, variegated or mottled tops. This is the dominant type within which occur variation from green-mottled with horizontal strips

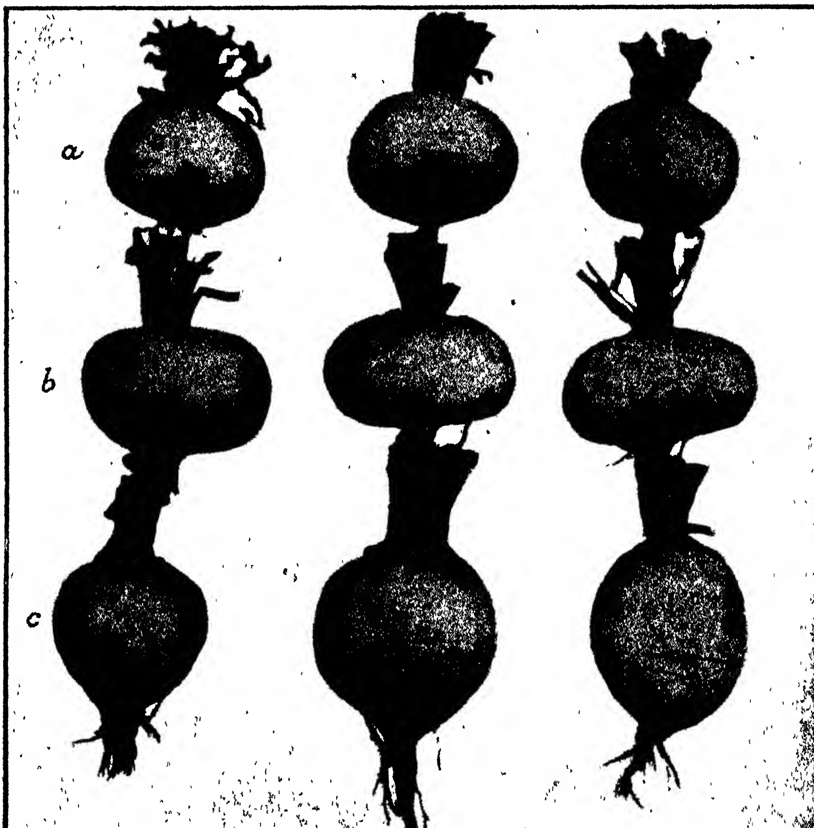


FIG. 11.

a Whitestone Stubble ; *b* Early Six Weeks ; *c* Pomeranian White Globe.

of reddish-purple to purples or reddish-purples through which green shows on horizontal strips ; colour below ground-level is white. Skin-texture smooth. Flesh white. Maturity, early.

The distribution of varieties is shown in the following table (Table 4) as a percentage of the area in white-fleshed turnips in each district and summary for New Zealand. No attempt has been made to differentiate between Hardy and Imperial Green Globe nor between Red Paragon and Lincolnshire Red Globe.

TABLE 4.—THE DISTRIBUTION OF WHITE-FLESHED TURNIP VARIETIES IN NEW ZEALAND STATED AS THE ACREAGE IN EACH DISTRICT AND AS A PERCENTAGE OF THE AREA IN WHITE-FLESHED TURNIPS IN EACH DISTRICT, WITH A SUMMARY FOR ALL NEW ZEALAND.

Area devoted to	East and West Southland Mid and South Otago	Central and North Otago, South Canterbury.	Mid and North Canterbury	Marlborough and Nelson.	Manawatu and Wanganui	South and North Taranaki.	Wairarapa, Hawke's Bay, and Poverty Bay.	Waikato, King-country, and Central Plateau	North and South Auckland, Bay of Plenty	All New Zealand
All varieties—Acreage ..	22,800	28,950	63,400	5,300	18,300	5,300	6,200	1,750	7,350	159,410
Purple Top Mammoth—										
Percentage	13·3	5·0	5·8	12·3	21·6	13·8	14·4	38·1	30·7	11·6
Acreage	3,042	1 447	3,654	655	4,068	735	895	666	2,260	18,422
Hardy Green Globe, Imperial Green Globe—										
Percentage	59 1	80·7	67·4	71·5	71 2	75 9	66·1	52·5	48·7	68·4
Acreage	13,295	23,390	42,790	3,790	13,045	4,077	4,100	919	3,582	108,989
Red Paragon, Lincolnshire Red Globe—										
Percentage . ..	16·6	13 0	17·5	3·0	*	9·7	13·5	3·7	6·2	13·2
Acreage	3,800	4,040	11,100	160	81	518	835	65	462	21,061
Early Six Weeks—										
Percentage	*	..	*	..	..	..	..	*	..	0·64
Acreage	37	..	951	..	.	..	.	31	..	1,020
Devonshire Greystone—										
Percentage	7·9	*	*	5 6	..	*	2·4	..	11·9	2·62
Acreage	1,816	73	951	300	.	30	153	..	877	4,198

* Under 2 per cent of the area of the district.

REVIEW.

Turnips and swedes are grown extensively in New Zealand for forage purposes, but the distribution and utilization of the different types are determined by their distinct specific characteristics.

Soft or white fleshed turnips contain about 8 per cent. of dry matter and have the poorest feeding-value. They are therefore the lowest fertility-demanders and can be grown on relatively poor soils, where their success depends more particularly on the periodicity of the rainfall ; on better land they may be expected to produce comparatively heavier yields. Their great adaptability is responsible for their wide distribution (Table 1). They are the earliest to mature but are the poorest keepers, and are generally fed to stock in the late autumn and early winter.

The yellow-fleshed turnips form an intermediate group between the soft turnips and swedes. They contain about 10 per cent. of dry matter and are, in consequence, of greater nutritive value than the white-fleshed varieties, they are later in maturing than soft turnips, their keeping-quality is satisfactory, and they are fed to stock during the late autumn and early winter. The conditions, however, under which these yellow-fleshed varieties thrive limit their distribution, they can be grown most successfully in a damp, rather cool climate, and are therefore more popular in Southland and Otago than in the North Island (Table 1).

Swedes contain about 12 per cent. of dry matter and are superior in nutritive value to turnips. They are rather high fertility-demanders and require fertile condition and copious rainfall for favourable development, thus they are grown chiefly in the western districts of the North Island and the southern parts of the South Island Again, their susceptibility to insect-attack and to such diseases as club root and dry-rot tend to restrict their production where these are prevalent. The growing of swedes in certain parts of Canterbury is, during most seasons, rendered almost impossible because of the association of dry weather conditions and severe aphis infestation Swedes take longer to mature than either the white or the yellow fleshed turnips, are of excellent keeping-quality, and may be fed to stock during the winter or early spring ; storage increases their feeding-value.

"Roots," as a winter forage crop, provide an excellent succulent ingredient to the animal's diet. Such material, provided it is fed with discretion, is of value in that it is comparable to summer grass, and, due to its laxative effect and palatability, exercises a favourable influence on the health and productivity of both herds and flocks.

Since the inauguration of certification in the 1929–30 season, well over half a million bushels of perennial rye-grass seed has been sealed and tagged as certified seed. In the 1932 33 and 1933-34 seasons almost one-third of the total perennial rye-grass seed production was certified, while it is probable that a certain proportion of the uncertified seed can be traced back to a certified origin. The ear-marking of this quantity of seed has given purchasers an opportunity of selecting high-quality seed in a market where previous to the introduction of certification good, medium, and poor strains were sold more or less indiscriminately.—*Director of Fields Division, Annual Report.*

LEMON-CULTURE.

W. K. DALLAS, Citriculturist.

(Continued.)

PLANTING-OPERATIONS.

For heavy or moderately heavy soils that are liable to remain cold and sodden during the winter months spring planting is preferable to autumn planting, since the soil is in better condition after lying fallow during the winter. Further, as the trees are set out in soil which is becoming warmer, the roots soon establish themselves. Autumn planting is suited to most well-drained soils provided the land is well worked prior to planting

The trees should be planted on the square system, as this facilitates cultivation. Trees to be set out on better-class land should be planted from 25 ft. to 30 ft. apart. The former requires sixty-nine trees per acre and the latter forty-eight trees per acre. It is not advisable to plant trees closer than 25 ft., as a less distance does not allow for the land between the trees to be effectively worked or cover-crops grown when the trees reach full stature.

For the purposes of economical working, as well as general appearance, it is important that the trees be planted in lines, so that from whatever point they are viewed the rows look perfectly straight. Full details in connection with the laying-out of an orchard is given in Bulletin No. 84 (New Series) entitled, "Orchard Establishment and the Establishment of Young Fruit-trees."

PLANTING.

The sites for the trees having been marked with pegs, the holes should be dug and the soil removed and scattered broadcast. Before planting it is advisable to mix lime, superphosphate, and bone-dust together—three of lime, two of superphosphate, and one of bone-dust—and to place six handfuls of the mixture into each hole and work it well into the soil. If not attended to when heeled-in the roots of the young trees should be examined and damaged parts cut off

In the process of transplanting there is always some loss of roots. The tops should be lightened to balance this loss, as it is difficult to re-establish a tree with a head heavy in proportion to the roots. This may be effected by removing superfluous branches— three to four main branches being sufficient to make the foundation of a tree—or by shortening growths as the case may require, or by both removing and shortening shoots In the case of pot-grown trees it is necessary to disentangle the roots, and unless the soil can be removed easily the ball should be immersed in water and all the soil washed away. The roots can then be spread out in a proper manner. When a young tree is furnished with spreading roots it is well to make a mound in the centre of the hole, on which to place the tree with the roots pointing down the sides of the mound. The soil for filling in is obtained by digging the surrounding soil forward. The advantage of this method is threefold: it breaks down the walls of the hole, does away with a possible pot-hole for water, and ensures that nothing but top soil will

come in contact with the roots. If the soil is of a heavy nature the filling-in should be done with a digging-fork. It is advisable to tread the soil firmly over the roots but to leave the surface soil loose. During the planting-operations the roots should not be left exposed to the summer wind or allowed to become dry. To neglect this precaution may cause a loss of trees.

Pruning.

In the study of the methods adopted for the pruning of lemon-trees it is found that a great many trees are not pruned sufficiently. While over-pruning is not recommended, the pruning should be sufficient to maintain a fairly open-headed tree furnished with a good supply of thrifty fruiting laterals. Except for the winter and early spring months, pruning may be carried out at any season of the year. The most suitable period, particularly if heavy cutting has to be resorted to, is in the spring at the commencement of tree-growth, when the wound-gum is present in sufficient quantity to protect the tissues against the entrance of disease through the wounds.

The pruning of the tree should begin with the one-year rod from the bud. The height at which the one-year tree should be cut will depend upon the height that it is desired to make the head. For convenience in working the orchard the tendency now is to prune the rod back to a height of about 3 ft. from the ground. It is, however, advisable to cut a little higher for the following reasons: Firstly, it is impossible to be sure of keeping the top shoot. Top shoots are frequently strong in growth, and until well on in the season their hold on the main stem is not too secure. In windy places they are liable to be blown off, which may be disastrous to the development of a well-balanced tree if other suitable branches are not available. Secondly, some trees send up the first shoots too near to the perpendicular. If the young tree is headed a little higher than the top branch is required the upper shoots crowd the lower ones out, and so the desired angle to form a broad base to the trees is obtained. Further, there are other branches to select from in case any are blown off.

During the first year after the heading-back of the rod the shoots which develop should not be touched as the tree needs as much foliage as possible with which to develop a good root-system strong branches, and to protect the trunk from the sun.

In the second year the branches to form the framework should be selected. Each tree should have from three to four main branches, the distance between the lowest and highest being from 10 in. to 12 in. The lowest branch should be at least 2 ft. from the ground. The branches should be arranged spirally on the trunk and not opposite each other, because when leaders are in whorls they are liable under stress to break away from the trunk. Those branches which are not required should be removed carefully.

Young trees received from the nursery in most instances are branched trees two years from the bud with the head already formed. When the young trees are planted shoots not required should be removed in order to restore the balance between the top and the root. Normally the selected branches do not need shortening, but where they have made very strong growth it may be desirable to head them back.

The trunks should be protected from sun-scald either by white-washing or by wrapping newspaper or other suitable material around them.

During the first three years after planting very little pruning is necessary—merely sufficient to keep the trees upright, to develop a shapely open, balanced head, and to remove superfluous shoots. Branches which are growing strongly to the detriment of others may require heading-in to increase the strength of weaker branches and to induce lateral growth. The trees should have as many leaders as will fully furnish the tree without crowding.

There are a number of methods adopted by growers to develop the framework of the trees. One method which gives a tree of the desired symmetrical form and openness of head is to select three or four leaders, which should be inclined at about a 45° angle. This should be done at the end of the second or the third year after planting, when the trees are well established and strong growth has been made. Of the vertical growths which arise from the leaders two strong well-spaced vertical shoots should be selected. Other vertical shoots should be either kept in subjection or removed, and the leader shortened back to the outside selected vertical growth. Two years later, when the selected shoots have made strong growth, each should be cut back to two suitably placed strong lateral shoots, thus doubling the number of leaders. From the vertical shoots which arise from these laterals one shoot on each should be chosen, and two years later, when these selected shoots have made strong growth, each should be shortened back to a strong lateral-growth The treatment of the past two years should be repeated until the trees reach a height of 10 ft. In most situations the trees should not be allowed to exceed 10 ft to 12 ft. in height, as such a height allows of much of the fruit being gathered from the ground and of pruning and spraying being more readily carried out. This system of training provides shapely trees, each having from twelve to sixteen leaders which should carry heavy crops without undue bending. The centre of the trees should not be allowed to become filled with vigorous shoots.

Young lemon trees should receive attention two or three times a year for the purpose of cutting back branches that are outgrowing the remainder of the tree and to remove suckers, especially should they arise from the trunks of the young trees.

To maintain a maximum supply of fruiting wood the stronger subsidiary lateral growths should be pinched back to cause them to send out fruiting wood nearer to their base and close to the main branches. Trees with an open centre carry fruit both on the inside as well as on the outside of the trees. The lower growth should be kept well above the ground-level and all straggling shoots and branches cut back to preserve as nearly as possible an even contour in the whole tree. All brush (unthrifty lateral growth), water-shoots, and dead and dying wood appearing in the tree should be pruned out entirely. If the wood is young and vigorous the fruit will develop better, and much of it will mature in the summer. Growth that has been injured by frost should be cut back to sound tissue. A fairly open head in the tree fosters fruiting laterals and facilitates effective spraying. When a tree is allowed to grow with little or no attention it may produce a fair crop for a time, but much of the fruit will be on the ends of branches

where it is liable to sway with the wind and become rubbed and bruised. Branches may be also broken by the weight of fruit, thus reducing the productiveness of the tree. To keep the mature tree shapely and fruitful it is desirable that it should receive attention once a year. Neglected trees are difficult to spray and often become infected with fungous diseases and infested with insect pests to an otherwise avoidable degree.

Sharp secateurs to enable smooth cuts to be made are essential as are also a sharp saw, and a knife to smooth off the tissues ruptured by the use of the saw. A protective wound-covering should be applied to all wounds over half an inch in diameter.

Cultivation.

The depth to which the soil may be cultivated is governed by type of soil and depth of rooting of the trees. As there is a tendency for young lemon-trees to develop roots near the surface the ploughing during the first few years should be relatively deep near the trees. The space around the trees not reached by the plough should be hand-dug, and any roots met with near the surface severed close to the trunk by a clean cut. As the trees increase in size the ploughing should be restricted to the area outside the spread of the trees, and the ground beneath the trees can then only be surface-cultivated. When this stage of the tree development is reached the trees will have a well-established root system in the middle and lower strata of soil. The importance of a good depth of well-cultivated soil cannot be too strongly emphasized, because unless this is provided the roots cannot long remain sufficiently active to produce continuously heavy crops of fruit suitable for commercial purposes.

The amount and character of cultivation, however, given to an orchard must be governed to a large extent by the nature of the soil and the climate. Usually it is best to plough to a depth of from 6 in. to 8 in. in the autumn and cross-plough in the spring. During the summer months the surface should be kept loose with a cultivator, ploughing at that time being inadvisable, as it tends to dry the soil

In the autumn the first furrows may be turned up against or towards the trees and an open furrow left in the middle of each "land" between the trees In the spring the order is reversed, and thus the soil is brought back to its original position. The spring ploughing should be done as early as practicable, either in August or early September, and should cover all weeds and trash lying on the ground. The soil should then be worked down to a fine tilth, which should be maintained throughout the summer. The ground under the trees should be dug over to a depth of from 5 in. to 6 in. at least three times a year. In working soil where the main mass of feeding roots have been allowed to become established close to the surface the depth of cultivation should not be so deep as to cause a serious loss of roots.

The effect of cultivation upon the soil organisms (bacteria, fungi, and protozoa) is often overlooked. It is to these countless silent workers that a rich soil mainly owes its fertility. Thorough aeration,

obtained only by cultivation, is necessary for the micro-organisms to thrive and carry on their important work of soil improvement.

COVER CROPS.

For the successful growing of lemons it is essential to have a soil with a high humus-content. Besides assisting with the elaboration of plant-foods, especially nitrogen, organic matter increases the capacity of the soil to retain moisture and improves the aeration of the soil. The humus-content should be built up by green manuring before planting the orchard, and while the trees are young and deep ploughing is possible. To maintain the trees in thrifty condition after they have come into bearing cover-cropping should be continued.

Legumes are most suitable for cover crops, since they grow rapidly and are rich in nitrogenous matter. Those recommended are horse-beans, lupins, vetches, and field peas used either alone or in combination with oats, barley, &c. A mixture of equal quantities of superphosphate and carbonate of lime often may be broadcasted profitably with cover crops at the rate of 6 cwt. per acre.

In some districts weed-growth may be sufficient to maintain an adequate humus-content of the soil. During the early summer weeds, on account of their demand upon soil-moisture, should be suppressed, but when early autumn rains are experienced they may be allowed to grow. Where the herbage of weeds is allowed to grow it would be good practice to augment it with a legume broadcast early in February to come up in advance of the weeds.

Before ploughing a green crop under it is good practice to cut it into pieces with the disks, as this ensures a more even distribution of the organic matter. A green crop should not be ploughed in while the soil is in a dry state, unless it be in the late autumn with winter rains soon to follow. A fair amount of soil-moisture is necessary to ensure the decay, and when moisture is in scant supply the crop decays very slowly. Green manuring should not be carried out during the later part of the spring or summer, since the bulk of the material may remain undecomposed thus keeping the soil open with a consequent loss of valuable moisture.

It is recognized that a green crop ploughed into the soil may have at first a temporary impoverishing effect, reducing for a time the available nitrogen. It is therefore necessary that green crops should be turned in at a time when the trees are requiring a minimum amount of nitrogen, this being about midwinter. Soil-moisture is usually abundant at this time, and decomposition should be well advanced before the trees reach full activity.

For the first four or five years vegetable crops may be grown between the rows of trees. It usually is advisable to manure for these crops, and they should not be planted so close to the trees as to interfere with the young roots. If these matters are attended to intercropping is beneficial, as the cultivation necessary for the crops improves the condition of the soil. Potatoes, kumaras, tomatoes, peas, beans, and other leguminous crops are suitable.

FERTILIZERS.

To obtain profitable crops and maintain satisfactory growth citrus trees require ample supplies of plant-foods. Although the turning-in of cover crops and frequent cultivation do much to enrich the soil the addition of artificial manures is also necessary. Manuring, however, should not be overdone. Experiments have shown that nitrogen and, to a less extent, phosphates and potash increase yield and improve the quality and hardiness of the new growth. Best results are obtained with fertilizers where there is an ample supply of decaying organic matter and moisture in the soil.

Nitrogen encourages growth. Fertilizers which contain nitrogen are sulphate of ammonia (20 per cent. nitrogen), nitrate of soda (15·5 per cent. nitrogen), blood and bone (4 per cent. to 8 per cent. nitrogen), dried blood (10 per cent. to 12 per cent. nitrogen), bone-dust (3 per cent. nitrogen), and farmyard, sheep, and fowl manure. Nitrate of soda should not be used regularly upon clay soils. Blood and bone, which also contains phosphate, is used extensively by citrus growers. It takes usually at least four times as much blood and bone as sulphate of ammonia to supply a given quantity of nitrogen. Sulphate of ammonia is generally the cheapest per unit of nitrogen, but as its regular use increases soil acidity an annual application of 1½ lb. carbonate of lime for each 1 lb. sulphate of ammonia is necessary, applied about one month prior to the spring application of nitrogen.

Phosphates promote root-growth, better setting of fruit, and earlier maturity of crops. Phosphates are normally supplied as superphosphates, basic phosphates, basic slag, blood and bone, and as bone dust, but the particular form used depends on local conditions and cost.

Potash is stated to improve flavour and the colour and smoothness of the skin. It is abundant in the majority of New Zealand soils, and in most localities only small dressings are necessary. Wood ashes that have not been weakened by rain are also a source of potash as well as of phosphates and should not be wasted. Where plenty of such ashes are available no other potash will be needed; about 500 lb. per acre is an adequate dressing.

Other manures which may be used are blood and bone, well-matured fish manure, and meat-meal. Lime improves the physical condition of heavy soils, and is also useful in correcting soil acidity.

RECOMMENDATIONS FOR APPLICATIONS OF MANURES.

If possible, organic matter, such as cover crops, farmyard, sheep, fowl, and well-conditioned fish manure, &c., should be turned in annually.

The fertilizers recommended for young non-bearing trees, distributed over the area occupied by the roots, are—For the first year after planting sulphate of ammonia and superphosphate, ½ lb. each, and sulphate of potash, ¼ lb. per tree, followed by an annual increase of ½ lb. of the two former and ¼ lb. of the latter per tree until the trees come into bearing. In addition, carbonate of lime should be applied at the rate of 1½ lb. for every 1 lb. of sulphate of ammonia used.

The quantities given in the following table are to be used as a basis for manuring bearing trees from four years to twelve years from planting.

Annual Dressing of Fertilizers for Bearing Trees from Four Years to Twelve Years from Planting.

Fertilizer.	Period of Application.		
	Spring (August-September)	Early Autumn (April)	Late Summer (January-February).
Sulphate of ammonia	2 lb. to 5 lb. per tree..	2 to 5 lb per tree	..
Lime (carbonate) ..	1½ lb to each 1 lb. of sulphate of ammonia applied Apply at least one month prior to dressing of sulphate of ammonia and work into soil	..	3 cwt. per acre combined with superphosphate mentioned below
	(Above treatments to be applied within spread of trees)		
Superphosphate ..	3 lb per tree, applied within spread of tree prior to deepest working	..	3 cwt per acre broadcast at time of sowing cover crop
Potash (sulphate) ..	1½ lb per tree combined with phosphate	..	..

Nitrate of soda may be substituted for sulphate of ammonia if desired For older trees the dressings, in most situations, should be increased.

Diseases and Insect Pests.

Fungous diseases and insect pests are more readily controlled when the trees are given good care. A tree crowded with growth provides a suitable harbour for pests and renders treatment very difficult. Important factors in the control of diseases and insect pests are proper attention to drainage, improvement of the soil, pruning, and the maintenance of clean surroundings, including the gathering and the destroying of decaying fruit before the spores are ready for dissemination. A bulletin dealing with the treatment of diseases and pests of citrus in New Zealand is in the course of preparation

Renovating Old and Unthrifty Trees.

Trees may become unthrifty from a variety of causes, such as a heavy infestation of insect pests or the presence of fungous diseases, want of systematic pruning, bearing continuously heavy crops of fruit, or old age. So long as the roots and trunk are sound it is possible to restore trees of poor production to a thrifty condition Such trees may have a good deal of dead wood, may have run up in a straggling manner, or have lost branches through breaking down. These trees should be treated by cutting back the broken, dead, and diseased branches to healthy tissue and removing superfluous growth. The heading-back of the main branches should be done in the early part of October and should not be too severe the first year, but only partially done so as to avoid removing too much foliage before new growth develops.

The tree during the spring and early summer should be then sprayed two to three times with a summer oil at a 2½-per-cent. dilution. In the winter following the appearance of the new shoots upon the lower parts of the tree the renovating may be continued. The hard cutting of the tree back to the main leaders should be done about July. Branches removed should be cut back to the branch or trunk from which they issue, so as to leave no "snags." Large wounds should be painted over either with Colas (a bitumen product), Stockholm tar, or a thick mixture of white-lead and oil. The trunks and limbs exposed to the sun by pruning should be protected from sunscald by applying a coat of white-wash. The soil around these trees should be cultivated deeply towards the end of April, before the late autumn or winter rains set in. The cultivation should become deeper with increasing distance from the trunk. Any available well-rotted manure or orchard and garden refuse should be worked into the soil around the trees. Should a good rain not be experienced within a fortnight the subsoiled trees should be given a good watering. The trees will soon push out numbers of new shoots. These should be thinned to the number required to furnish the tree with new branches and be afterwards subjected to the same shortening as described in a previous paragraph under the heading of pruning. Trees that are dying because of roots lost from disease or from unsuitable soil conditions obviously cannot be resuscitated, and should be destroyed.

Top-working Trees *

Trees that are in a healthy condition can be reworked with other varieties, either by budding or grafting. Usually the former method is adopted, as grafting of citrus trees is somewhat uncertain. The buds should be worked into young wood, which is obtained by heading back the trees to a suitable point on the main limbs at the beginning of October. The new growth should be thinned out during the summer, leaving sufficient selected shoots which, when worked, will refurnish the trees with new branches. If the wood has attained sufficient size the buds may be inserted during the following March, if not, the budding will have to be deferred until the following November

In the former case the buds remain dormant till spring. When growth starts the branches should be headed down to within 8 in. of the buds. It is not advisable to head close to the buds, as the sap in the wood left above affords nourishment to them and serves as a support to which the resultant shoots may be tied to prevent them from being blown off. The stump above the bud should not be allowed to make any growth and should be cut off as soon as the shoots are strong enough to support themselves. Shoots arising from the limbs and any remaining branches should not be removed immediately, but kept in subjection by thinning and heading back for two seasons, until the branches arising from the bud-wood are well established. If grafting is decided on, the trees should be headed back about midwinter, leaving about 1 ft. length to be cut from each limb or branch when the scions are put on. The "crown graft" method is best. It should be carried out between mid-August and mid-September. The exposed tissues should be carefully covered with petrolatum jelly or grafting-wax.

* If further information in reference to budding and grafting is desired it may be obtained from the following departmental bulletins. Bulletin No. 81, "The Budding of Fruit-trees"; Bulletin No. 98, "The Grafting of Fruit-trees."

Picking, Curing, and Marketing

The care and skill required for picking, curing, and marketing lemons is as great as that needed in establishing and maintaining the orchard itself, and the results obtained at the harvesting stage necessarily mean success or failure of the whole venture. That lemons can be grown successfully in the warmer parts of the Dominion has been amply demonstrated, but this is not in itself sufficient to ensure the establishment of a successful lemon industry. There is demanded in addition a much more complete knowledge and practice of the art of curing than at present obtains in New Zealand to enable the grower to carry his fruit with a minimum of loss over such periods as the exigencies of the market may demand.

(To be continued.)

SEED CERTIFICATION.

SUMMARY OF OPERATIONS FOR SEASON, 1934-35

J. H. Claridge, Certification Officer, Fields Division, Wellington.

The following summary covers the activities of the Fields Division of the Department of Agriculture in relation to seed certification in the 1934-35 season, the eighth season of operation.

Extensions in the scheme during the season have been made to cover the certification of Italian rye-grass seed, while an additional class of perennial rye-grass seed has been formed, in which the qualification for certification is a satisfactory report upon examination by means of ultra-violet light.

The returns show an increase of 11 per cent. in the number of entries made in the season just completed, increases being shown in respect to all seeds except perennial rye-grass, turnip, and swede seeds, relative to which appreciable decreases are recorded.

Perennial Rye-grass.

An additional class, "Certified Commercial Seed," was introduced during the 1934-35 season. While the seed of this class is not subject to such rigorous testing as is the seed certified under other classes, the test applied, nevertheless, is of such a nature that the "certified commercial" seed includes only those lines of definitely perennial habits. In very many cases seed certified in this class would under a different system of testing qualify in the "Permanent Pasture" or even the "Mother" class of seed. The procedure used is, briefly, to seal temporarily and sample lines of machine-dressed seed in store and submit the sample for test by ultra-violet light. Upon the result of this test the sacks are either sealed as certified seed, or else unsealed and left as ordinary uncertified seed. Despite the fact that the scheme was not introduced until March of this year, the amount of seed certified to the end of September totalled 41,500 bushels.

In the "Mother" and "Permanent Pasture" classes a further reduction in acreage inspected (from 13,236 acres to 11,351 acres) is recorded. However, because of an increase in average yield of

$2\frac{1}{2}$ bushels per acre, the amount of seed finally sealed and tagged has increased by 21,000 bushels, to give a return of 141,000 bushels. The grand total of perennial rye-grass seed certified during 1934–35 amounts to 182,500 bushels, an increase of 52 per cent. over the 1933–34 returns.

The germination of all lines this season has been entirely satisfactory, while only in a few instances has any difficulty been met in attaining the necessary standards of purity.

Cocksfoot.

Cocksfoot seed certification has proceeded along the usual channels during the 1934–35 season. With a 45-per-cent. increase in the acreage entered, coupled with an average yield of more than double that recorded for 1933–34, the total produce sealed and tagged amounts to 716,000 lb., compared with 200,000 lb. for the previous season. The proportion of seed certified on the Akaroa Peninsula, under the immediate supervision of the Akaroa Cocksfoot Seed Growers' Association, has fallen considerably, despite the fact that the total produce from this district shows a considerable increase. The greatest increase in production was in the Mid-Canterbury district, where the acreage entered was doubled, while average yields rose from 36 lb. to 220 lb. per acre.

Practically all the seed was certified in the " Mother " class, less than a ton of seed being classed " Permanent Pasture," this being because it was harvested from young areas.

White Clover.

The amount of white-clover seed certified during the 1934–35 season was 93,000 lb., as compared with 20,000 lb. during the 1933–34 season. Increases have been recorded in all three classes. The " Mother " and " Permanent Pasture " classes each show an increase in production of over 100 per cent The greatest increase, however, is shown in the " First Harvest " class, where the production has increased from a little over a ton to 22 tons. All seed in this class is " once-grown " from Mother seed, so that the benefits of the change of basis of certification from one of age of pasture to one of type of clover, made in the 1931–32 season, are now becoming evident.

A further 8,700 lb. of field-dressed seed harvested from certain areas in the North Canterbury district, and considered to be of a reasonably good type, has been held under official supervision pending the receipt of a sample trial report. This amount is slightly less than the quantity similarly held in 1933–34.

Brown-top.

The growers of brown-top have added their share to the increase recorded in the amount of seed certified during 1934–35. With the number of areas entered increasing from 103 to 215, and the amount of seed sealed and tagged increasing from 119,000 lb. to 384,500 lb., the reason for the fall in price of this seed during the season is not hard to find. While Otago has again produced the most seed of any one district, Southland has shown the greatest increase in production Mid-Canterbury and South Canterbury districts have between them produced 98,000 lb. of seed, almost three times the amount produced in these districts in the previous season.

RED CLOVER.

The acreage of Montgomery red clover entered for certification in 1934-35 is more than double that for the previous season. One and a half tons of Mother seed and 12 tons of Permanent Pasture seed have been sealed and tagged, as against a total of 7½ tons during the season 1933-34. The demand for this seed appears to be good, and reports indicate that farmers are now more appreciative of its worth.

ITALIAN RYE-GRASS

The certification of Italian rye-grass seed was undertaken this season for the first time The type aimed at is one which will produce a high bulk of leafage in its first season, and at the same time will come away for further feeding after cutting. Twenty-one areas had been sown down with seed once grown from imported lines of known good type, and these formed the basis for the scheme. Fourteen areas passed the necessary standard at field inspection, and the produce of these, amounting to over 5,500 bushels, was sealed and tagged as certified seed.

WHEAT.

Despite a decline in the acreage of wheat entered for the 1934-35 season, the actual acreage passed (1,334 acres) is over 200 acres more than that passed in the previous season The quantity of seed sealed after machine-dressing has increased from 6,000 bushels to 11,000 bushels It is interesting to note that over 2,000 bushels of the new variety—Cross 7—has been placed on the market after being finally tagged and sealed.

POTATOES.

A further increase of 84 crops has brought the number of crops inspected during the 1934-35 season to 513. The percentage of crops passed has increased from 76 per cent to 87 per cent., in spite of the fact that a higher standard in regard to freedom from virus diseases has been insisted on

The division of crops into "Mother" and "Commercial" and the regulation disallowing the re-entry into certification of those areas where Commercial seed had been planted, has given the grower a great degree of security in regard to the acceptance of his crop when re-entered for certification, as is shown in the following figures.

Crops inspected in 1934-35	Total Number	Number rejected	Percentage rejected
Areas planted with Mother seed ..	377	10	2·7
Areas planted with Commercial seed ..	79	38	48·1

In most cases the amount of virus in rejected crops is lower than what may be expected in an average uncertified crop, and, in fact, the rejected crops in the main would have been certified in former years. This serves to indicate the raising of the standard in regard to certified potatoes, even though a higher percentage of crops is being passed.

Table giving Quantities of each Seed certified and Estimate of the Total Value of Seed certified in each Season.

Seed.	Chief consideration upon which Certification is based		Quantities of Seed finally certified.							
			1927–28.	1928–29.	1929–30.	1930–31.	1931–32	1932–33.	1933–34.	1934–35.
Potatoes ..	Varietal purity, cropping-power, and freedom from virus disease	Tons	217	249	511	760	818	938	1,806	1,821
Wheat ..	Varietal purity and freedom from loose and stinking smuts	Bush.	3,840	11,682	16,714	4,060*	1,283*	7,001	6,012	11,110
White clover	Age of pasture, 1928–31, type of clover, 1931–35	Lb	..	10.595	69,015	67,242	6.131*	33,731	20.337	93.381
Perennial rye-grass	Genuine perennial type	Bush.	..	..	17,052	45.982	81,186	245,667	119.019	182,386
Brown-top	Freedom from red-top (*Agrostis palustris*)	Lb	..	..	170.071	171,083	198.343	138,843	118,978	384,588
Cocksfoot ..	Type as exemplified in the produce of Akaroa Peninsula	,,	..	..	..	..	171.720	622,765	200,560	715,982
Red clover	Type conforming to that of English-grown Montgomery red clover	,,	..	..	..	..	1,550	3,763	17,263	30,558
Brassicas ..	Varietal purity and freedom from disease	,,	..	..	..	..	..	..	22.515	522
Italian rye-grass	A rapid-growing, high-producing type, showing recovery after cutting	Bush.	.	..	..	..	..	..	..	5.121
Estimated value of seeds finally certified			£2,070	£4.889	£30.328	£40,048	£57,358	£142,585	£79,018	£154,725

* Reductions accounted for by changes in regulations.

Total estimated value of seed certified (1927–35), £511,021.

The number of entries in the qualification trials has increased slightly. The condition of the samples received indicates that there are still a large number of crops being grown from seed which is infected badly with virus and far from pure. This seed could, without exception, be replaced with certified seed, with profit to the grower.

BRASSICA CROPS.

The amount of turnip-seed certified this season was very restricted, while no swede crop was entered. Two nucleus areas of rape-seed of specified type have been grown under certification.

GENERAL.

The accompanying table records the quantities of seed of each crop finally certified since the inauguration of seed certification in 1927. By fixing a basic value for each seed an attempt has been made also to show the total value of all seeds certified from season to season. It should be remembered in connection with this table that seed sold in a field-dressed condition, and, in regard to potatoes, seed sold as provisionally certified, has not been included.

Persons or firms interested in the complete tabulated results may obtain copies of these on application to the Director, Fields Division, Department of Agriculture, Wellington

CORTICIUM-DISEASE OF POTATOES.

THE EFFECT OF CROP ROTATION ON ITS PERSISTENCE IN THE SOIL.

F. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North

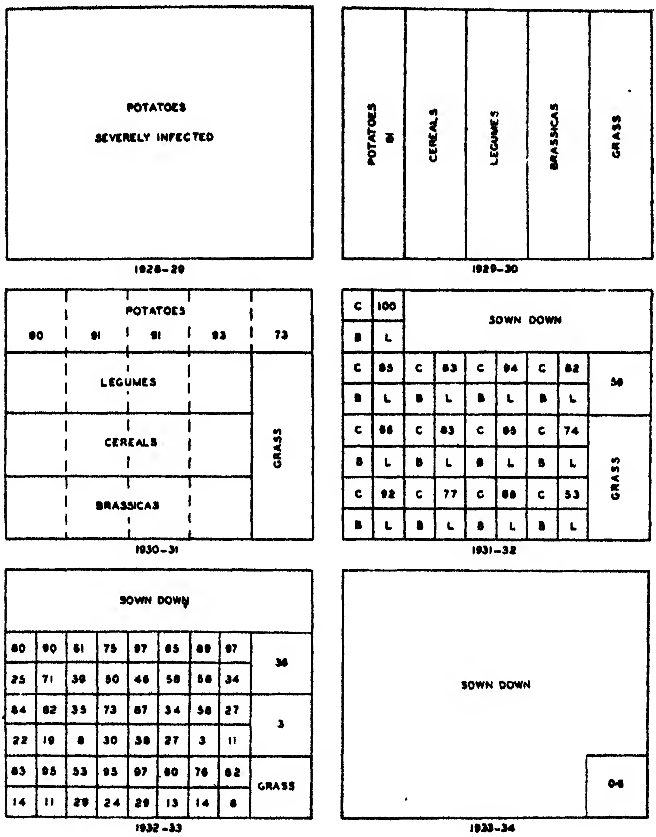
CORTICIUM-DISEASE, caused by *Corticium vagum* Berk. et Curt., is one of the commonest and most widely distributed diseases of potatoes. Because of its prevalence it has received much attention in both this and other countries. Under New Zealand conditions its symptoms, economic importance, and control have already been discussed (Cunningham, 1925; Cunningham and Neill, 1926; Chamberlain, 1931, 1932, (*a*) and (*b*). The disease attacks a wide range of plants and is both tuber and soil borne. No advantage is to be gained by planting clean tubers in infected soil and many workers* have suggested crop rotation as a means of eliminating soil infection. In order to obtain information with reference to the effect of various crops on the persistence of corticium a crop-rotation experiment was laid down. The nature of the rotations planned may be seen from the accompanying figure. Three years' results of a portion of this experiment have already been published (Chamberlain, 1931), but are being recorded again in the present article.

Details of the experiment are as follows:—

1928–29.—The whole area, which was $2\frac{1}{2}$ chains long by 2 chains wide, was planted with corticium-infected potatoes. An inspection of the crop was made during harvest and a high percentage of the tubers found to be infected.

* References to literature dealing with host range, soil persistence, and the effect of crop rotation on corticium are given in a previous article (Chamberlain, 1931).

1929–30.—The area was divided into five blocks each 2 chains long by ½ chain wide and sown as indicated in the figure. Since no corticium-free potatoes were available the potato block was planted with infected tubers which had been treated by the acidulated corrosive sublimate method.* During harvesting counts were taken and 81 per cent. of corticium infection was recorded. A control plot of 120 tubers from the same line of treated seed, planted in soil which had not previously grown potatoes, showed 8 per cent. infection at digging.



PLAN OF ½ ACRE PLOT SHOWING CROPS GROWN DURING EACH OF SIX SUCCESSIVE YEARS.

The figures represent in each case, the percentage of corticium infection.

The letters C, B, and L used on the plan for the 1931–32 season indicate that cereals, brassicas, and legumes respectively were grown on the lettered plots.

The areas in the 1931–32, 1932–33, and 1933–34 seasons marked "sown down" represent portions of the plot withdrawn from the experiment.

1930–31.—Sowings were made as indicated in the figure. The potatoes planted were seed tubers hand-selected for freedom from corticium infection and then treated by the acidulated corrosive sublimate method. The percentage of infected plants which each plot showed at harvesting is given in the figure. A control plot of ninety

* This treatment is as follows: The potatoes are soaked for one hour and a half in a solution of 1 part corrosive sublimate, 6·6 parts concentrated hydrochloric acid, and 1,000 parts water.

plants from the selected treated seed, grown in soil where there had not been a previous crop of potatoes, showed complete freedom from the disease.

From a consideration of the results it appears that one year in cereals, brassicas, or legumes had no effect on the incidence of corticium infection, but that grass did appear to reduce slightly the amount of infection.

1931–32.—The greater portion of the area was divided up into blocks ¼ chain square and sown with various crops as shown in the figure. Again the potatoes planted were hand-picked, treated seed. The figures given represent the percentage of corticium infection in each potato plot.

It would appear that a two-year rotation with cereals, brassicas, or legumes brought about a slight reduction in corticium infection, though this reduction was not so great as that produced by two years in grass.

1932–33.—Except for one section withdrawn from the experiment and one grass plot ½ chain square, the whole area was planted with hand-picked treated potato tubers. The influence of the various crop rotations is shown by the percentage infections given in the plan.

From these results it would appear that cereals are slightly less effective than brassicas or legumes in reducing corticium infection, and that three years in grass considerably reduces the amount of disease.

1933 34.—The remaining grass plot was planted with corticium-free potatoes. Only 160 tubers were planted, and of the resulting plants one developed corticium.

Apparently the bulk of the soil-infection had disappeared from this plot, which had been four years in grass.

SUMMARY.

(1) Crop rotations of two or three years with cereals, brassicas, and legumes tended to reduce the amount of corticium infection in the soil.

(2) Cereals appeared to be slightly less effective than brassicas or legumes in reducing soil-infection.

(3) Grass gave a greater and more consistent reduction in the amount of corticium infection than did any of the above-mentioned crops

(4) Four years in grass practically eliminated the disease from the soil.

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The Fields Division Officer at Blenheim reports that subterranean clover at Ben Morven has spread well up the hillsides and over otherwise bare clay faces. The sward is excellent and the sheep relish the clover

SOME ASPECTS OF THE SMALL-SEED INDUSTRY IN OTAGO AND SOUTHLAND.*

WITH PARTICULAR REFERENCE TO RYE-GRASS SEED AND THE ESTABLISHMENT OF A PERMANENT EXPORT TRADE.

J. O. WALLACE, Fields Division, Department of Agriculture, Dunedin.

THE production of small agricultural seeds, particularly rye-grass, is no new industry in Otago and Southland, which rank in the forefront among provinces in respect to the production of these seeds.

Rye-grass for seed-production was grown quite extensively as far back as 1870, and then evidently it was considered an important industry, for in the papers of Sir Julius Vogel, printed in 1875, and relative to Otago, the commercial price of rye-grass seed is shown as from 3s. 6d. to 6s. a bushel. It can be taken for granted that to command attention in such a paper the rye-grass seed crop must have been of some moment.

The production of fescue and of brown-top seed in such quantities as to include them in the export category originated much later—fescue in the early years of the current century and brown-top later still, actually in 1921.

About 1870 a growing demand for southern oats arose, the demand developing not only in New Zealand, but also in Australia and Tasmania, and in 1883 southern districts harvested 157,000 acres for grain. The present acreage harvested is approximately 37,000 acres. The demand for oats, which were required principally for horse-feed, grew out of the extensive programme of private and public works embracing road and rail construction After the oat crop it appeared to be the general practice to follow with a short lea, the sowing being English grasses with rye-grass dominant in the mixture, and it was invariably the practice to take a seed-crop the first or second year In the absence of definite data a good measure of the quantity of grass-seed harvested at the period can be obtained from the acreage of oats harvested, bearing in mind that all the land had to be resown to grass. Liming of the soil was not practised to any extent at this period, and as Yorkshire fog and sorrel became troublesome, constituting impurities that were difficult to remove by manually operated riddles, minds of the commercial men engaged in the industry were, by virtue of necessity, turned towards the possibility of power-operated seed-cleaning machines, and the period 1880-85 saw the first commercial power-operated seed-dressing plants established in the South. Much of the seed which went into commerce in the early days of the industry was lacking in the state of purity which we find to-day, and "bushel-weight" was the paramount factor in the buying and selling of grass-seed.

Following on from this period and in an endeavour to show the trend or stability of small-seed production in southern districts recourse has been made to the agricultural statistics, and a number of years taken at random. Figures for Canterbury, also an important seed-producing area, are given for comparison, also those for Hawke's Bay and Gisborne districts grouped together for a similar purpose.

* Substance of a paper presented at the Conference of the New Zealand Grassland Association at Christchurch, August, 1935

In the year 1898–99 the areas, in acres, harvested for seed-production were—

	Rye-grass	Other Grass and Clover Seeds.
Southern districts	23,252	3,798
Canterbury	24,749	26,277
Hawke's Bay and Gisborne ..	7,046	4,054

"Other," relative to southern districts, while not definitely stated, no doubt refers to timothy and dogstail. Southland at this time enjoyed a fair trade in timothy to the North Island.

In the year 1904–5 the areas, in acres, harvested for seed-production were—

	Rye-grass	Other Grass and Clover Seeds
Southland	15,985	1,638
Canterbury	7,074	35,791
Hawke's Bay and Gisborne ..	7,598	2,852

For the year 1911–12 a return was prepared from data collected during October and November, a time most opportune for the collection of reliable data. For this particular year the areas, in acres, harvested for seed-production were

	Rye-grass	Other Grass and Clover Seeds
Southland	39,831	4,482
Canterbury	19,071	28,053
Hawke's Bay and Gisborne ..	4,626	1,376

In the year 1921–22 the areas, in acres, harvested for seed-production were—

	Rye-grass	Other Grass and Clover Seeds
Southern districts	23,107	13,792
Canterbury	23,097	20,917
Hawke's Bay and Gisborne ..	2,241	67

In this year the area utilized in the Wellington Province for the production of small seeds was almost equivalent to the area used for the same purpose in Hawke's Bay and Gisborne Districts

In the year 1930–31 the corresponding areas were—

	Rye-grass	Other Grass and Clover Seeds
Southern districts	18,997	18,525
Canterbury	22,036	18,711
Hawke's Bay and Gisborne ..	5,066	523

In the Wellington District the production of small seed declined to insignificant quantities.

In the year 1933–34 the corresponding areas were—

	Rye-grass	Other Grass and Clover Seeds.
Southern districts	17,390	21,869
Canterbury	19,651	20,639
Hawke's Bay and Gisborne ..	5,989	768

Seed-certification commenced with the 1929–30 season. It was hoped that the organization would be instrumental in making available sufficient supplies of better strains than that widely grown

in southern districts not only to meet our own requirements, but to provide a balance for export. In the initial stages of the work the possibilities with the certified type of rye-grass in developing an external trade appeared quite good, and the development of such a trade seemed a matter only of producing sufficient seed. Most merchants, especially the exporting houses, willingly co-operated with officials of the Department of Agriculture in giving publicity overseas to the work being done in connection with strain improvement in grass and to the virtues of the certified product.

Southern growers accepted the adverse reports directed against their local types of rye-grass, but appreciated the possibilities of a permanent export trade with the declared better regional strains of the North Island. Having gained a full knowledge of the cultural methods by long practical experience, and having available the machinery required for harvesting, &c., they embarked on the growing of the certified strains of rye-grass with some enthusiasm. In the first year merchants contracted with growers to purchase the crops at a premium, and growers were anxious to obtain seed though it was costing up to 27s. 6d. per bushel. One grower alone, specially prepared, sowed and harvested 225 acres for seed. Unfortunately it was ascertained subsequent to threshing the crops that the seed, while normal in appearance, was of very low germination and not marketable, though crops of the southern strains produced seed of normal germination. This resulted in a serious setback not only to growers of rye-grass in Southland, but to the rye-grass-certification scheme. As a result of the low germination progress has been to some extent arrested in the southern seed-producing areas, and the sowing of the certified type of rye-grass with seed-production in view is not now enthusiastically entertained

The data given previously show that rye-grass seed-production in southern districts has been more or less constant from the "eighties," and it is of moment that yields per acre in southern districts are double those of the North Island and greater than those of Canterbury. The failure of the certified strain of rye-grass in the South has been openly discussed and some subscribe to the view that the southern district must surrender its position in the production of rye-grass seed. In this connection the question arises, Can we afford to let this happen ?

That there are possibilities of building a permanent export trade in certified rye-grass seed is accepted generally in official and commercial quarters, and the following figures support this contention. For eight months, May to December, 1933, the export of perennial rye-grass from New Zealand was as follows : Certified, 2,008 cwt., value, £2,710 ; uncertified, 13,978 cwt., value, £16,150 ; other rye-grass, 18,595 cwt., value, £21,889. It is apparent that our overseas customers have purchased our uncertified seed because, no doubt, there was no certified seed available at the price offering, but a certain class of uncertified seed may become an obstacle to the building-up of a permanent trade in certified seed.

If we could produce the certified seed in sufficient quantities to have available sufficient supplies for export at a reasonable price, overseas buyers would purchase our seed not on the policy

of having to, owing to short supplies in their own countries, but on the realization that it was a superior strain. Should southern districts cease producing, would it be possible for other districts to produce sufficient to meet internal requirements, and at the same time have a sufficient balance for export at an attractive price—not 10s. to 12s. per bushel, but at 5s. to 6s. per bushel, which would be a payable and encouraging price to southern farmers? It seems, in view of the preceding considerations, that this is highly impossible. It appears obvious, therefore, that if the districts of the South relinquish rye-grass seed-production, which they may do unless the low-germination obstacle is overcome, the prospect of establishing a permanent export business of creditable dimensions is small, as influences operating in other parts of the Dominion seriously hinder the production of the required regular supplies. A rise in the price of meat and wool would, it is believed, be followed by a further decrease in seed-production in the North Island. The rise in the price of wool two years ago was followed by a substantial decrease in certified seed-production, and there appears to be a return to those farming operations allied to the staple industry of the district—*i.e.*, meat and wool production.

Eyes might turn to Canterbury, but a rise in the price of wheat might have the same effect as the rise in the price of wool in Hawke's Bay. Again, drought is to some extent against the venture, and as a result regular supplies cannot be relied upon. In any case, with southern districts eliminated it would be necessary to double Canterbury's present crop to meet internal requirements, let alone to leave a substantial balance for export.

Through the failure of the certified rye-grass to produce viable seed under ordinary conditions in southern districts, New Zealand is probably losing many thousands of pounds annually.

The matter of raising improved strains in grass is of first importance to southern farmers, and they are anxious to see a measure of the work of selecting and breeding undertaken in their own district. Their case seems to be strengthened by the fact that the difficulty of low germination was not unmasked until the selected certified strain was brought to southern districts for commercial cropping, whereas the work of selecting and determining the value of the selection was confined exclusively to the North Island.

In regard to small-seed production New Zealand has in Otago and Southland a veritable inheritance. Practically every important common species of grass and clover can be grown successfully for seed. One may point to, the revenue from the export of browntop and fescue seed, and merchants must be commended in fostering the production of these seeds and in finding overseas markets for them without national assistance.

There is still ample scope for expansion, and much of the seed now imported could be grown here. In 1933, 3,201 cwt. of timothy was imported, whereas it can be grown successfully in Southland. A fair trade in the seed of this species was enjoyed by southern growers up till 1905, but it rapidly fell away through shipping lines containing ragwort seed.

It is gratifying that some of the principal merchants are encouraging the growing for seed of some of the species now

imported almost wholly by supplying the stock seed and guaranteeing to buy the produce. Growers are pioneering the production of seed of crested wheat-grass, millet (fair amounts of which reach this country from England, though most of it is grown in Turkey), and *Phalaris tuberosa*, and to these will probably be added Indian hemp, to meet our own domestic and probable export requirements; particularly does this apply to *Phalaris tuberosa*, a good opening for which appears to exist in Australia.

Apart from figures relative to acreage, &c., the amount of small-seed production in Southland may be gauged from the fact that there are in constant operation eighteen commercial seed-dressing plants in Otago and Southland.

DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF THE 1934–35 SEASON.

W. M. SINGLETON, Director of the Dairy Division, Department of Agriculture, Wellington.

THE past season witnessed a definite falling-off in the number of cows submitted for test, while a climatically unfavourable dairying season resulted in a decline in average production of tested cows. Some 256,931 cows were tested, as compared with 297,647 for 1933–34, representing a decrease of 40,716 cows, or 13·67 per cent. The average butterfat-production per tested cow was 252·01 lb. a falling-off of 10·43 lb. fat over the previous season's average of 262·44 lb. While, however, there was a decrease in the number of testing dairy-herd owners, and consequently of cows, it is pleasing to note that the total number of groups was not merely maintained, but increased. A return to better butterfat prices and more normal conditions should make it possible to regain the lost ground.

Table 1 provides statistics relating to dairy cows in milk and dry, and covering the past ten years. The steady advance in New Zealand's dairy-cow population is obvious.

Table 1.—Dairy Cows in Milk and Dry as at 31st January of each Year.

Season.	Total Cows.	Cows in Milk.	Dry Cows.	Percentage of Dry Cows to Total.
1925–26	1,303,856	1,181,441	122,415	9·4
1926–27	1,303,225	1,181,545	121,680	9·3
1927–28	1,352,398	1,242,729	109,669	8·1
1928–29	1,371,063	1,291,204	79,859	5·8
1929–30	1,441,410	1,389,541	51,869	3·6
1930–31	1,601,633	1,499,532	102,101	6·4
1931–32	1,702,070	1,582,664	119,406	7·0
1932–33	1,845,972	1,723,913	122,059	6·6
1933–34	1,932,511	1,816,402	116,109	6·0
1934–35	1,952,094	1,827,962	124,132	6·4

Table 2 provides a numerical classification of tested cows according to land district, and covers the past five seasons. From this table it will be noted that all the important dairying districts show a decrease, while for the whole of New Zealand the tested cows represented 14·5 per cent. of the total cows in milk. This is the lowest percentage since the 1925–26 season, when the corresponding figure was 14·4, the highest yet recorded being 20·4 for the 1929–30 season.

Table 2.—Numbers of Cows tested Twice or more, and Percentages of Total Cows in Milk, classified according to Land Districts.

Land District.	1930–31.		1931–32.		1932–33.		1933–34.		1934–35.	
	Cows tested.	Percentage of Total Cows in Milk.	Cows tested.	Percentage of Total Cows in Milk	Cows tested.	Percentage of Total Cows in Milk.	Cows tested.	Percentage of Total Cows in Milk.	Cows tested	Percentage of Total Cows in Milk.
North Auckland ..	55,283	20·9	56,091	19·6	59,408	18·8	55,801	16·4	47,658	13·7
Auckland	102,534	22·6	99,806	20·6	111,517	21·1	120,982	21·3	110,107	19·0
Gisborne	10,418	25·0	9,145	20·4	10,634	19·9	12,460	21·8	12,069	20·7
Hawke's Bay ..	8,742	16·7	4,933	9·2	5,910	10·3	5,581	8·9	5,476	9·0
Taranaki	32,519	14·7	31,179	13·8	32,302	13·6	38,878	15·7	31,599	12·7
Wellington ..	35,875	16·7	30,569	13·6	34,992	14·6	38,290	15·2	38,022	15·5
North Island ..	245,371	19·7	231,723	17·6	254,763	17·8	271,992	17·8	245,531	15·9
Nelson	5,732	20·9	6,637	23·7	7,430	23·8	4,445	13·6	4,714	14·8
Marlborough ..	3,064	19·2	2,647	16·2	2,334	13·6	2,067	11·9	1,269	8·0
Westland	2,380	18·8	5,030	39·6	2,844	20 4	2,801	19·2	2,006	14·0
Canterbury ..	3,244	4·3	2,344	3·1	4,359	5·4	4,957	6 0	4,195	5·2
Otago	3,775	7·0	4,480	7·9	4,800	7·9	3,752	6·1	2,605	4·4
Southland ..	7,838	10·9	6,996	9·4	9,524	11·7	7,633	9·3	5,624	6·9
South Island ..	26,033	10·2	28,134	10·6	31,291	11·0	25,655	8·8	20,413	7·2
Dominion ..	271,404	18·0	259,857	16·4	286,054	16·6	297,647	16·4	265,944	14·5

NOTE —" Total Cows in Milk " is at 31st January in each year

Table 3 is a summary indicating the number and size of the various organizations. In the sense used for this tabulation an "organization" denotes an individual unit—that is to say, a Group Herd-testing Association operating ten groups would be included as ten, not one.

Table 3.—Number of Cows, Herds, and Organizations represented in Season's Summaries received. (Basis : All Cows in Milk 100 Days or over.)

—	1932–33.	1933–34.	1934–35.
Group Testing.			
Number of groups	200	213	222
Number of herds	5,090	5,120	4,559
Number of cows	253,016	266,481	240,993
Average number of herds per group	25	24	20
Average number of cows per herd	50	52	53
Average number of cows per group	1,265	1,251	1,086
Association Testing.			
Number of associations	78	73	58
Number of herds	1,242	1,105	889
Number of cows	23,163	20,408	15,938
Average number of herds per association ..	16	15	15
Average number of cows per herd	19	18	18
Average number of cows per association ..	297	280	275

Table 4 is a general production summary. Figures for 5,448 herds were surveyed for the compilation of this table, of which 4,559 were tested under the Group system and the remaining 889 under the Association-own-sample test system. The corresponding figures for 1933–34 were 6,225 herds—5,120 Group and 1,105 Association. A point worthy of note is that despite the unfavourable season the average milking period for Group cows increased by three days.

Table 4.—Grand Summary of all Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

	1933–34.			1934–35.		
	Number of Cows.	Days in Milk.	Butterfat-production.	Number of Cows.	Days in Milk.	Butterfat-production.
			lb.			lb.
Average for all cows	286,889	255	262·44	256,931	258	252 01
Average for all Group cows	266,481	257	264·10	240,993	260	253·65
Average for all Association cows	20,408	230	240·79	15,938	227	227·08
Highest Group average ..	294	282	334·25	638	270	308·55
Lowest Group average .	1,022	225	194 00	856	241	194·18
Highest Association average	108	264	337·90	66	277	339 70
Lowest Association average ..	106	208	178·91	120	201	156 15
Highest Group herd .	15	305	551 00	20	290	484·00
Lowest Group herd	24	192	88 00	10	117	80·30
Highest Association herd ..	4	312	435·07	6	278	448·00
Lowest Association herd ..	22	126	92·00	10	122	64·46
Highest Group cow	..	261	879·00	..	248	828·00
Highest Association cow ..	..	294	775·00	..	289	777·00
Average daily production of butterfat for all Group cows	..	..	1·03	..	..	0·98
Average daily production of butterfat for all Association cows.	..	..	1·05	..	.	1·00

Table 5 classifies average butterfat-production of tested cows according to land district.

Table 5.—Average Production, according to Land Districts, of all Cows under Herd-test for which Seasons' Summaries were obtained.
(Basis : 100 Days or over.)

Land District.	1931–32.			1932–33.			1933–34.			1934–35.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.
			lb.			lb.			lb.			lb.
North Auckland	54,101	253	229·56	57,771	255	245·53	54,007	250	241·11	46,037	255	243·38
Auckland	97,218	260	233·61	108,504	264	254·67	116,769	260	262·09	106,983	263	249·12
Gisborne	8,853	250	242·29	10,265	251	254·73	11,967	251	247·50	11 686	251	239·83
Hawke's Bay	4,808	253	246·71	5,595	255	263·61	5,389	253	258·75	5,300	250	247·73
Taranaki	29,960	257	256·41	31,686	265	276·19	37,790	264	286·32	30,781	267	277·88
Wellington	29,215	244	226·03	32,012	253	255·61	36,491	255	275·64	37,010	253	253·07
North Island ..	224,155	256	235·32	245,833	260	255·62	262,413	257	262·41	237,797	260	251·86
Nelson	6,447	236	250·16	7,215	239	269·27	4,322	245	272·36	4,564	251	261·61
Marlborough	2,567	239	247·67	2,151	239	249·70	1,944	228	232·63	1 204	255	264·83
Westland	4,902	232	241·59	2,816	236	260·89	2,773	241	273·17	1,997	234	270·04
Canterbury	2,155	219	226·67	4,129	223	233·38	4,449	236	255·26	3 785	216	222·35
Otago	4,319	236	252·03	4,685	238	249·02	3,568	229	264·85	2,136	241	266·40
Southland	6,896	237	261·26	9,350	235	256·32	7,420	227	264·66	5,448	237	255·91
South Island ..	27,286	234	249·63	30,346	235	255·11	24,476	234	262·76	19,134	237	253·84
Dominion	251,441	253	236·87	276,179	257	255·57	286,889	255	262·44	256,931	258	252·01

GOVERNMENT SUBSIDY.

The New Zealand Herd-testing Central Executive held three meetings during the season. The Government subsidy for the current financial year amounts to £4,000, and arrangements have been made for allocation on lines similar to those adopted in the past, excepting that the subsidy per cow for Association-own-sample testing is to be discontinued. It is anticipated, however, that the herd-testing movement may be reorganized before next season, and in this event it is probable that the present will be the final year of subsidy on a per-cow basis.

APPRECIATION.

We again desire to thank officers in charge of herd-testing organizations for having provided the statistics required for the compilation of this summary.

THRIPS: WITH SPECIAL REFERENCE TO "THE GREENHOUSE THRIPS."

J. MUGGERIDGE, Entomologist, Plant Research Station, Palmerston North

THE *Thysanoptera*, or thrips as the insects of this order commonly are called, are small and inconspicuous; what they lack in size, however, is easily compensated for by their numbers, since they are very prolific and are found on a wide range of plants

Some of the chief characters which serve to distinguish these animals are the protrusible, bladder-like organ of the foot, the cone-shaped mouth parts, and the narrow wings, which, when present, are fringed with long hairs. The wings lie horizontally when at rest, and appear as a narrow strip along the surface of the abdomen.

The life-cycle of thrips commences in the egg-stage. The eggs are laid either on the surface of the host plant, or are inserted into the tissue by means of a sharp saw-like ovipositor Following the egg-stage there commonly are two larval stages both of which bear a strong resemblance to the adult form in general appearance. A prepupal and a pupal stage follow next, during which the animal moves but little and takes no nourishment. From the pupal form the adult insect finally emerges. The time taken in completing the life-cycle varies considerably for different species, and is also strongly influenced by temperature conditions.

The food of thrips consists of plant juices, obtained by breaking open the plant cells by means of a chafing and rubbing action on the leaf or fruit surface and sucking the liquid contents with the cone-shaped mouth Injury to plants is caused by attack on the foliage, the floral portions, and the fruit, "thrips-injured" foliage usually presenting a characteristic silvery-grey appearance. In severe attacks the foliage becomes brown, dry, and brittle, and subsequently dies, the plant thereby receiving a severe set-back. Injury to the flowering portions of a plant may cause the blossoms to drop prematurely so that the proper setting of seed or fruit is prevented. Direct injury

to fruit gives it a brown russety appearance and reduces considerably its market value Of recent years thrips have been proved to be carriers of mosaic diseases of plants.

Greenhouse Thrips.

The greenhouse thrips (*Heliothrips haemorrhoidalis* Bouché) (Fig. 1) is one of the commonest and one of the most universally distributed of thrips pests. It occurs in the open in tropical and semi-tropical countries, but is commonly found under glass in colder regions. The following brief description gives the easily noticeable characters by

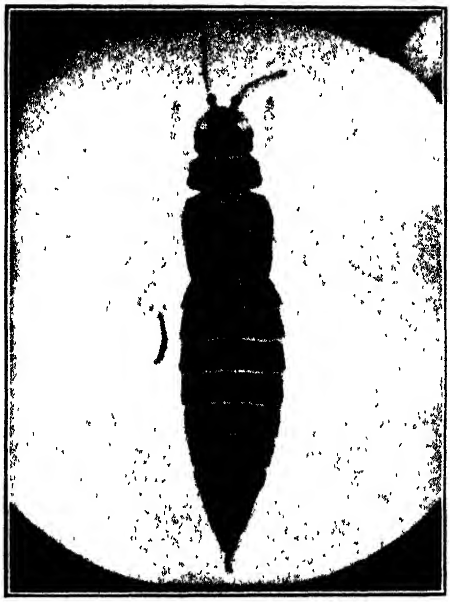

FIG. 1. ADULT GREENHOUSE THRIPS, SHOWING NET-LIKE MARKINGS ON HEAD AND THORAX.

[Photomicrograph

which it may be recognized. It is a small insect measuring approximately $\frac{1}{20}$ in. in length. Its body is covered with deep net-like markings, which are heaviest on the head and thorax, it is blackish-brown in colour, though specimens newly emerged from the pupal state appear whitish-yellow about the abdomen, the legs and antennæ are light-coloured except that the first, second, and sixth antennal segments are shaded brown, the eighth antennal segment is long, thin, and tapering.

HABITS.

Reproduction is always parthenogenetic i.e., the eggs are unfertilized. The whole of the life cycle is spent on the host plant By means of the sharp, saw-like ovipositor the eggs are inserted into the plant tissue; the young larva on hatching commences to feed and grow, and, after passing through the typical stages already described, the adult insect emerges. Under greenhouse conditions generations follow each other

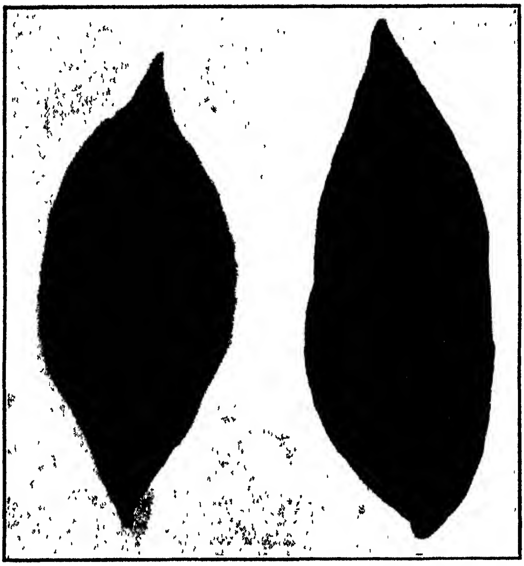

FIG. 2. COMPARING A THRIPS-INJURED LEAF (LEFT) WITH A NORMAL HEALTHY LEAF (RIGHT).

[*Photo by H. Drake*

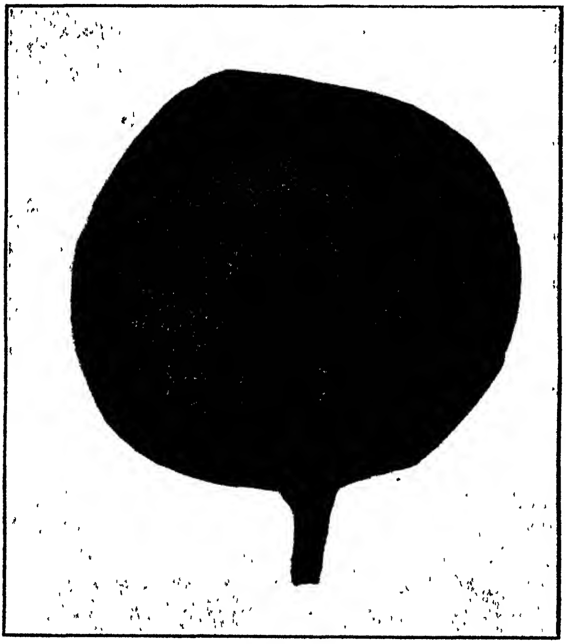

FIG. 3 CITRUS FRUIT SHOWING SEVERE THRIPS INJURY.

[*Photo by H. Drake.*

throughout the year. The accompanying illustrations (Figs 2 and 3) show typical injury caused by these pests to (*a*) plant foliage and (*b*) citrus fruit. The injury to the fruit gives it a brown russety appearance, and in the case of severe attacks the skin tends to crack.

HOSTS.

Some of the host plants recorded by the writer in New Zealand are citrus, persimmon, apple, peach, tung-oil tree, rhododendron, and azaleas.

CONTROL

One of the best natural checks to this pest is a hard dashing rain. Where it is found necessary to resort to artificial-control measures, nicotine sulphate (40 per cent.)—commercial "Black Leaf 40"—at a strength of 1 part in 800 parts of water plus 3 lb of soap per 100 gallons of spray can be applied with safety Because the eggs are not affected by the above spray, further applications at ten to twelve day intervals are advisable.

Under glasshouse conditions cyanide-fumigation will be found to be effective, for details regarding the use of which see this *Journal*, pp. 47-48, January, 1934.

ACKNOWLEDGMENTS

The writer wishes to thank those officers of the Horticulture Division who forwarded thrips material to him from time to time.

RECENT AMENDMENTS TO DAIRYING REGULATIONS.

UNDER THE DAIRY INDUSTRY ACT, 1908.

A. E. MORRISON, Solicitor Department of Agriculture, Wellington

BY the Dairy-produce General Regulations, Amendment No 3, which came into force on 12th September, various amendments have been made to the general regulations governing the manufacture and export of dairy-produce. In the following notes the principal changes in the law are recorded

Hitherto no definition was provided for the term "private dairy" for the purposes of the regulations, but premises not sufficiently equipped with appliances, drainage, &c., to justify registration as a creamery or a cheese-factory were registrable as a private dairy. Since the restrictions on the transfer of supply do not apply to private dairies supplies of milk or cream for any registered private dairy could be drawn from any farm-dairy in open competition with owners of creameries and cheese-factories. The operations of a private dairy are now restricted to the supply of milk or cream produced from cows depastured on the farm-dairy so registered, the average number of which in any month does not exceed fifty.

With a view to securing improved conditions in and about farm-dairies various amendments have been made which are designed to improve the quality of the supply from such dairies In the case of

milking-machines provision is made for the connections to the vacuum tank from the vacuum-pump releaser, &c., to be fitted with approved unions so as to permit the connections to be readily dismantled. In addition to being notified in all cases where it is intended to erect a new milking-machine, or to re-erect a used milking-machine on a farm-dairy, an officer of the Dairy Division for the district must now be notified of intention to erect or re-erect a vacuum pump or a milking-machine engine. The floor of the milking-shed, yards, and exits must be made of concrete or other material impervious to moisture. Where skim-milk is delivered from the separator to a pipe connected with a skim-milk pump the pipe must be of tinned brass and be provided with a union at the skim-milk pump so as to permit the pipe and pump to be readily taken apart and cleansed. The arrangement and design of the separator-room and engine-room on the farm-dairy where both rooms are under the same roof have been modified to permit the walled passage between the two rooms to contain openings only of such sizes as are necessary to provide for the transmission of motive power by belt where a belt passes from the engine in the engine-room to a vacuum pump or a counter-shaft in the releaser-room

Hitherto it was illegal to add cream to milk delivered to a cheese-factory for manufacture into cheese without the previous consent in writing of the owner of the cheese-factory This penal provision has been extended to include the addition of any skimmed or partly skimmed milk to milk intended for delivery to any manufacturing dairy.

The provisions of the principal regulations relating to the grading of milk supplied to creameries, cheese-factories, and skimming-stations, and payment for milk not actually graded, have been amended to conform with the existing practice in manufacturing dairies where milk is not being graded daily. Proper records must be kept of all milk graded, showing the grade assigned to the milk received from each supplier and the day of grading where milk is not being graded daily.

By an amendment to the regulations governing the transfer of supply the open months in the South Island will in future be July and August instead of September and October as hitherto.

With regard to the waxing of cheese, provision has been made declaring that the waxing plant must not be erected in the curing-room or the packing-room of any cheese-factory, but must be housed in a separate room. If a door is provided from the curing-room or the packing-room to the waxing-room the door must be airtight, and if the curing-room or packing-room, as the case may be, is insulated the door to the waxing-room must also be insulated with not less than 2 in. of corkboard or its equivalent. No cheese shall be waxed which has developed acidity to a marked degree or which shows excessive weakness in body or any mould growth on the rinds. No such cheese, if waxed, shall be exported to the United Kingdom.

The general prohibition against marking butter for export with words indicative of high quality such as "Choicest," "Choice," "Superfine," or "Superior" has been modified to permit such words or words of similar import to be branded on packages of butter intended for export in the form of pats if the grade assigned to such butter is that prescribed for "Finest." If on being graded the quality of the butter is not, in the opinion of the Grader, of the standard prescribed for "Finest," he shall decline to furnish particulars of the grade or to issue a Grader's certificate until the words indicative of such high quality have to his

satisfaction been removed from the packages. No butter in the form of pats of a grade lower than that of "Finest" shall be exported in packages bearing thereon or enclosed therewith or attached thereto any such words indicative of high quality.

Various amendments are made to the specifications in respect of export butter-boxes. With a view to eliminating mould growth on butter-boxes the use of rotary-cut timber for the manufacture of butter-boxes is prohibited. The timber to be used must be sawn timber, and the ends of all boxes must be planed smooth on both sides. The thickness of boards for the standard box, the sub-standard metal-bound box, and the Saranac box must be of the dimensions hitherto prescribed in dry finished thickness. The boards for the top and bottom of the sub-standard metal-bound box are increased from 10¾ in. to 11 in. in width. The top and bottom boards of the box must be nailed to the sides by at least two nails per nailing edge evenly spaced between the metal bindings on the box. The thickness of the boards for the Saranac box must be not less than ¼ in. instead of ¼ in. as hitherto. Both side edges of each top and bottom board of the box instead of one side edge only as hitherto must completely cover the side edges of the adjoining side boards. The end boards of the box must be affixed by not less than four nails instead of three as hitherto. The timber used in the manufacture of cheese-crates must be of such species as are approved by the Director of the Dairy Division.

Hitherto it was required that cheese in grading-stores be held and delivered at different temperatures, varying according to the time of delivery from the store. Provision is now made that cheese delivered into a grading-store on or after 1st August and before 31st December must be held at a temperature of not less than 47° or more than 49° if delivered from the store on or before 31st December, and at not less than 42° or more than 44° if delivered from the store after the last-mentioned date. Cheese delivered into a grading-store on or after 1st January and before 1st August must be held at a temperature of not less than 42° or more than 44° until delivered from the store.

In addition to the foregoing, other amendments, being either consequential or of a more or less minor nature, and, in consequence, self-explanatory, are included in the regulations under review.

SEASONAL NOTES.

THE FARM.

Acute Need of establishing Reserves of Feed.

DURING the two immediately preceding years, primarily because of unfavourable seasons, the crops of both hay and silage saved in the Dominion have been unusually light. This, coupled with the fact that recently cold conditions unfavourable to growth have prevailed until exceptionally late into the spring, has resulted in a particularly heavy drain on reserves of feed still on hand, and so farmers generally are facing the coming season with relatively low reserves of feed.

As a rule, the supplies of hay and silage are below the economic needs of the stock being carried. Hence it is clear that the present position calls not only for a special effort during the current summer, to make effective use of all material that becomes available from grassland for conservation as hay or silage, but also for consideration to be given to the growing of special crops fitted to improve the feed position. Some of the most valuable crops available should already be sown, and for others the work of preparation should already be well forward, but it should be kept in mind in planning the provision of feed for the coming winter and spring that at times valuable use can be made of crops sown after mid-summer. Instances of such crops are cereals or temporary pastures sown on land which already has produced a crop in the current season. Thus if stubble is worked as soon as the oat crop is removed, the land may be sown in Western Wolths or Italian rye-grass and red clover, which will provide autumn and winter feed that is especially likely to be valuable to sheep-farmers under Canterbury and similar conditions. Similarly, cereals may be sown after oats or after soft turnips. While the preparation for these crops is not now seasonable it is seasonable to give these crops consideration in planning against the development of feed-difficulties ahead.

Haymaking of Major Importance.

Despite the well-warranted increase in the popularity of ensilage during recent years haymaking continues to be the major means of conserving surplus supplies of summer growth of grassland. In the latest season for which figures are available (1933–34) the area of grassland harvested for hay in the Auckland Province was 191,000 acres, while that devoted to ensilage was 55,000; the corresponding figures for Taranaki were 53,000 acres and 26,000 acres, while the Dominion figures were 378,000 acres for hay and 92,000 acres for ensilage. It might quite well be argued that the amount of hay saved should be increased rather than reduced and that at the same time the ensilage area advantageously could be made greater than the hay area. This is a moot point which can be left for the present since it does not affect the fact that, as things stand to-day, the hay crop is much more important than the silage crop.

Rightly, during recent years much attention has been given to preserving quality and avoiding wastage of the crop in ensilage. From the above facts it is evident that at least an equal amount of attention should be given to eliminating avoidable loss of feeding-value in haymaking. That this is particularly important is shown by authoritative figures which indicate that loss of feeding-value may readily be greater in haymaking than in ensilage: in the latter it attracts attention because it is, to a substantial extent, visible, whereas in haymaking it is likely to be overlooked because it does not obtrude itself.

Basic Causes of Poor Quality in Hay.

Essentially because of the common occurrence of unfavourable weather at the most suitable stage of pasture-growth for haymaking much of the hay saved each year is of markedly inferior quality, because either of waiting until favourable weather is experienced and thereby allowing the crop to become far too mature and stemmy or of mowing at the correct stage of growth and being forced to save hay during unfavourable weather. In short, in respect to his haymaking, the farmer often finds himself on the horns of a dilemma, and it is this dilemma that constitutes the strong case for increased attention to ensilage over wide areas. Normally relief is not obtainable by late closing to be followed by late mowing of the hay crop—as a rule late closing simply results in a light crop. Late mowing to coincide with favourable weather is undesirable not merely because it necessarily results in the production of inferior stemmy hay, but also because it tends to bring about a weakening and opening-up of the pasture and to prevent the development of a really satisfactory leafy aftermath which is likely to prove valuable as a source of highly digestible nutritious feed in the latter part of the summer when such feed is needed in dairying and is apt to be in scant supply. Because of the important advantages attaching to the cutting of the hay crop at the proper stage of growth it behoves us to utilize all means of enabling this to be done and of saving the crop in good condition at the same time.

Practices which beget Quality in Hay.

There is much evidence that cocking should be more widely practised. It is doubtful whether, in the principal haymaking districts, one can depend upon saving a heavy crop of hay in good condition without cocking, and in the case of crops of average yield, after making full allowance for the extra labour involved, cocking could be adopted with advantage on occasions when it is not practised. Cocking is to be looked upon as the ideal method of obtaining hay of the best possible quality when the weather is not altogether favourable, and although economic justification cannot be found in all cases for ideal methods there always should be sound reasons for rejecting them. Cocking proves especially valuable in the saving of lucerne and of clover hay of good quality—the leaves, which are the most valuable portions of these plants, are not so likely to be lost if cocking is carried out. When left in the swath in bright sunny weather the leaves dry and shrivel and when the hay is raked they crumble and are left on the ground. It is especially important that cocks be well made—there is a vital practical difference between a well-hearted and raked hay-cock and a mere heap. The heap readily becomes sodden when exposed to rain, so that in wet weather hay is just as well in the swath as in badly made cocks, but in well-made cocks which are able to shed much of the rain it is partly secured.

If broken weather occurs just after mowing, then, within reasonable limits, the crop should not be disturbed until good weather returns—any handling that the mown material receives makes it much more subject to the detrimental influences of bad weather. If bad weather seems imminent the cocking should be hastened, for the amount of washing-out of nutritive matter by rain is much greater when the herbage is in the swath—in the cocks the herbage may cover only one-fifth of the ground it occupies in the swath and so be subject to the washing-out effect on only one-fifth the amount of water.

In the building of the stack a good deal can be done towards securing hay of good quality. The site should be well drained and it should not be shaded in a manner which will eliminate the drying-effect of winds. For the stack-bottom there should be an ample supply of material, such as posts or branches of trees, which will provide a dry base. A stack as high as

is practicable should be built, so that the roof is small in proportion to the amount of hay. Especially in unfavourable weather, long, narrow stacks are to be preferred, because they allow of more ready drying and cooling. No one working on the stack should stand for a considerable time at one place, as this causes uneven settling. When mechanical means of hoisting the material on to the top of the stack are in use in conjunction with hay-sweeps, each load should be broken up and distributed evenly so as to avoid loosely packed "pockets" between the loads, with consequent uneven settling.

The most suitable time to cut lucerne cannot always be determined by the development of flowers. Safer guidance is obtained by noting the development of basal shoots—when new shoots coming from the bases of crown of the plants are about an inch long the lucerne should be mown.

Feed-utilization.

An important and common weakness of the feeding during early summer of "wet" stock, including ewes and sows, as well as dairy cows, arises in respect to the quality of feed as distinct from the quantity. The bulk or weight of such important summer crops as green lucerne, green maize, and green millet, as well as pasture-growth, is not at all a reliable measure of their nutritive value. The feeding-value of crops is governed by the nature of the dry matter—*i.e.*, the substance that would remain if all the water in the crop were removed. In its turn the nature of the dry matter varies greatly, even within a short period, and depends upon whether the crop is in a leafy condition or is allowed to become stemmy and productive of flower-heads. The dry matter of crops at a leafy stage of growth is very suitable for "wet" stock, containing a highly digestible and well-balanced supply of the substances required by such stock, whereas the dry matter of stemmy crops, broadly, is of the reverse type. These facts assist in indicating the need for methods of crop-utilization which result in leafy herbage being available to "wet" stock. Especially in respect to pastures is this matter of current moment; methods of maintaining pastures in the desirable leafy condition were discussed in last month's notes.

General Cropping-work.

The true role of special forage crops in this Dominion may be realized adequately only if it is kept in mind that the relatively expensive grains and meals used freely in many other countries may be replaced in New Zealand to a great extent by the comparatively inexpensive farm-grown, diluted concentrates provided by such crops as rape, soft turnips, mangels, &c. Actually our markedly economical production of fat lambs and of butterfat is dependent upon our cheap production of concentrates through the use of young leafy grass and suitable forage and root crops. A keynote in any programme of consistent success with arable crops must be thorough cultivation. Other important factors in success are good seeds and, as a rule, particularly in regions of good rainfall, more liberal manuring than is usually practised.

Of the crops commonly sown at this season the swede is of much importance. Successful results have been obtained widely and consistently by sowing swedes in December at the rate of 10 oz. to 16 oz. an acre. Sowing through every second coulter of an ordinary grain drill probably is most favoured, but sowing through every coulter has given good results repeatedly; and, especially in the South Island, sowing in ridges, followed by inter-tillage, has given good results consistently over many years. The question of varieties has been discussed at considerable length in the two previous issues of this *Journal*. Modern practice in districts of good rainfall is to use 2 cwt. to 3 cwt. an acre of manure of which phosphate is the chief constituent, while in districts of light rainfall, such as Canterbury, super-phosphate at the rate of about 1 cwt. an acre mixed with an equal amount

of carbonate of lime is favoured. The mixture, which should be made at least a week before using, should be left in a heap—if put into bags it tends to set hard. When the seed is to be mixed with the manure in sowing care should be taken to avoid the serious injury to the seeds which may result from bringing them in contact, even for a short period, with readily soluble manures such as superphosphate, sulphate of ammonia, and potash salts. Injury by superphosphate may be avoided by using the lime-superphosphate mixture specified above. Steps should be taken to guard against similar seed-injury to soft turnips and rape, the sowing of which often is carried out successfully at this time.

To provide green feed in summer maize and millet may be expected to give good results in the warmer districts when sown in December. As a rule they respond profitably to a dressing of superphosphate, &c., applied at the rate of 1 cwt. to 2 cwt. an acre, and, except in the case of highly fertile soils, it is likely to be also profitable to supplement the superphosphate with a nitrogenous fertilizer.

The continued popularity of chou moellier, and in some districts an increased popularity, is well justified. This popularity is due partly to the marked resistance of chou moellier to club-root, from which, however, it is not completely immune, and partly to its good feeding-value and to its ease of feeding to sheep with the minimum of waste in situations where the wet conditions would tend to beget undue waste in feeding root crops *in situ*. Chou mollier calls for high fertility such as is required for success with cabbages. If such fertility is not present naturally, it may be provided by suitable use of farm manure such as old stack-bottoms and animal excreta, together with artificial fertilizer in which superphosphate may well be prominent. Sowings in December provide winter feeding. A suitable sowing is 1½ lb. to 2 lb. an acre in drills 2 ft. to 2½ ft. apart.

Generally the best results are obtained by sowing lucerne in the latter part of November or in December Some information was given about lucerne establishment in these notes last month, and further information is available in Bulletin 155, which is obtainable free on application to any office of the Department of Agriculture.

Inter-tillage and Thinning.

Inter-tillage of growing crops sown in rows wide enough apart to allow of it is, as a rule, highly desirable at this season. Often in December such inter-tillage should be accompanied by thinning of crops sown in October or November. Generally the thinning may be made easier by prior hoeing along the rows. The weeding associated with such early thinning usually destroys great numbers of weed-seedlings. In thinning mangels the soil should be drawn away from the seedlings rather than to them. If at thinning-time mangels are pale and seem to be faring unsatisfactorily, they are likely to respond profitably to a top-dressing of nitrate of soda or sulphate of ammonia sprinkled along the rows, at the rate of about 1 cwt. an acre in such a way that the fertilizer is not deposited on the seedlings.

Miscellaneous.

Spraying for the control of potato-blight and other kindred crop troubles may be desirable. As a rule, satisfactory results are obtained from such spraying only when it serves as a preventive instead of as a cure. Spraying may be of considerable value in checking the spread of blight which has gained a footing, but its greatest service comes from preventing the footing being obtained. If the spraying is faulty in respect either to preparation or application, the result is likely to be either ineffective control of the trouble or damage to the crop itself. Detailed information about spraying may be obtained from local officers of the Fields Division.

Much valuable work in weed-control can be carried out in mid-summer. One aspect of this is the prevention of flowering and seed development in

perennial weeds. It is to be noted that seeds capable of reproduction often have developed earlier than the appearance of the parent plants suggests. Another phase of the work is the destruction of seedlings while they are still in the tender stage, when the task is relatively easy.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Pest and Disease Control.

Frequently many growers find the coming month a difficult one in which to keep pests and diseases under control. With the advent of hot, dry weather vigilance is often relaxed, and the period between sprays is unduly lengthened in the belief that all will be well while the weather lasts. It should be noted that hot, dry conditions favour the increase of scale insects, red mite, codling-moth, leaf-hopper, &c.; and where the frequency of sprays is not maintained one or more of these pests may gain a substantial hold. If the period between sprays passes well beyond the point at which the previous spray ceased to be protective, an unexpected precipitation of moisture may be experienced before a further protective spray is applied, with the result that much of the fruit may become affected with black-spot.

It becomes increasingly difficult to obtain a complete coverage as the density of the foliage increases. It is at this time that the benefit of an open-framed tree with a clear centre is appreciated. Each tree should be thoroughly sprayed, care being taken to see that the undersides of the leaves as well as the tops receive a coating of spray, as it is the habit of the red mite and leaf-hopper to frequent the undersides. Greater efficiency is secured by the application of sprays at a suitable pressure, and where it is low the pressure should be increased if possible, to at least 200 lb. at the nozzle.

For control of the various pests and diseases the sprays as recommended in last month's notes should be continued. From mid-December the strength of the lime sulphur given in the combination spray for apples should be reduced to 0·083 per cent. For the early summer treatment of red mite or leaf-hopper the addition of nicotine sulphate 40 per cent. at 0·05 per cent. to the combination spray is advised. The application of summer oils at 1·5-per-cent. dilution is not recommended until about mid-January on account of the frequency with which sulphur sprays are applied up to the New Year for disease-control. At least fourteen days should elapse following a sulphur or lime-sulphur spray before applying an oil spray.

Cultivation.

The cultivation recommended in last month's notes should be continued. If dry weather conditions prevail the use of the harrows is sufficient to maintain the tilth, but following wet weather it is advisable to make use of the cultivator or disks. Where cultivation has been maintained it is not necessary to make a ploughing at this period, and generally it is not a sound practice to do so, as excessive drying of the soil usually follows, unless the ground is thoroughly worked immediately following each day's ploughing.

Thinning.

During the coming month the second and further thinnings of the fruit should be pushed ahead according to variety and class of fruit. Where heavy crops have set care should be taken to see that the thinning is adequate. Most growers are aware of how unsatisfactory it is to harvest and market small fruit, which is expensive to handle. Small fruit can be obviated by systematic thinning. It is seldom that a grower over-thins his fruit, as

he usually concentrates his mind on what he has removed instead of the number of fruits still remaining upon the tree, and this causes him to err in leaving too much fruit upon the tree. However, no attention should be paid to the quantity removed: it is what still remains on the tree that should concern him.

Fireblight.

As advised in last month's notes, a careful watch should be kept for any signs of infection, and the time of thinning presents a further opportunity of detecting infections.

Handling the Crop.

The earlier varieties of stone fruit will shortly be ready for picking. The picking-receptacles and ladders should be now put in order so as to be in readiness when harvesting commences. Stone fruits require careful handling, and should not be roughly picked and tipped into boxes Benzine-tins cut the wide way and provided with clips and suitable straps make excellent picking receptacles. They are easily kept clean and free from disease. Sufficient tins should be provided for picking. Pickings should be frequent, and the fruit gathered at the stage known as hard ripe, which will enable the fruit to open up in the market in firm condition.

Careful grading and packing of the fruit into good clean cases is desirable, and for long-distance transit it is advisable to pack the larger fruit in trays. Stone fruit in trays almost invariably opens up in better condition and with less bruising than fruit in cases, and consequently realizes greater profit.

The use of second-hand cases for stone fruit is not recommended, as it is frequently the means of fruit becoming infected with brown-rot during transit. All diseased and rotting fruit should be promptly gathered and destroyed and not left hanging on the trees or lying about on the ground.

General.

In many districts the practice of growing cover crops, such as blue lupins, field peas, beans, vetches, &c., is not as general as it should be. The turning-under of cover crops not only increases the organic matter in the soil, but improves its mechanical condition, increases its power to retain moisture, and makes for easier cultivation. An adequate supply of humus greatly improves the soil fertility, and too many of our orchard soils are deficient in this respect. As the cover crop should be sown early in January to attain maximum growth before being turned under in the autumn, the necessary arrangements for seed-supply should be made shortly.

Case material should be secured as early as convenient and wet days utilized in making up a supply of cases, which can be stacked and allowed to season.

Grading-machines should be overhauled, cleaned, and put in readiness for operation; packing benches, lidding-presses, and rubber stamps should also be given attention. Wiring-machines should be sent for overhaul so that vexatious delays may be obviated at the commencement of the season. Orders for packing-material and supplies should be placed early and requirements carefully estimated.

—*R. G. Hamilton, Orchard Instructor, Hamilton.*

Citrus Notes.

The main blossoming of lemons in most districts will be now well advanced. As soon as the young fruit is showing it is advisable to spray with Bordeaux mixture (3–4–50) for control of verrucosis and scab, while any older fruit badly affected with disease should be removed and destroyed.

Where scales and thrips are in evidence spraying should be carried out with a summer-oil at a strength of 1–33 for red scale and for other scales 1–80

during the months of January and February. Spraying with lime sulphur 15 per cent., polysulphide content 1–40, or nicotine sulphate 40 per cent. 1–800 will assist in the reduction of the citrus-thrip infestation.

Young borers will now soon be active, and where the withering of the leaves is noticed the twig should be removed and the borer destroyed. The larger limbs may be treated by the injection of a drop or two of benzine into the holes and plugging with soap.

The long, wet period experienced in the Auckland district has soaked the subsoil and has benefited the trees. Every endeavour should now be made to attend to the cultivation. The ground immediately around the trees, as well as the "lands" between the trees, should be worked up to a fine tilth. Care, however, is necessary to avoid seriously damaging the feeding roots. Any sickly trees should be examined carefully for signs of collar-rot or bark-blotch, and affected trees should be treated by removing all the diseased bark, together with a small portion of healthy bark round the edges, after which it is advisable to paint the wound with Bordeaux paste or coal tar. This treatment will help to bring the trees back into a healthy condition. All citrus groves should be well drained, as insufficient drainage is often the means of the trees becoming infected with collar-rot in a wet season like the one just experienced. Where bark-blotch or other diseases are not found the roots of unthrifty trees should be carefully examined to determine the cause of the trouble so that the proper steps may be taken to rectify it so as to bring about good root-growth again.

The treatment of young trees should not be neglected, and all shoots arising at a low position on the trunk should be removed. Stong, perpendicular shoots not required for developing the framework of the tree should be cut back to induce lateral fruiting-growth.

Any budding required may be done during the month of November, or may be deferred until the autumn. When the work is done in the spring the shoots may be headed back to the bud at New Year, when good wood-growth may be expected to develop during the autumn.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Seasonable Culling.

FROM now onwards for the next few months accommodation on many poultry-plants will be taxed to its utmost. Overcrowding must be avoided if the best results are to be obtained, and the young, growing stock need plenty of perching-room if the desired development is to take place. It is a much wiser plan to rear a few birds well than a large number indifferently. The main problem is the difficulty of providing sufficient space for the growing birds.

Culling should be practised all the year round—*i.e.*, any unprofitable birds should be disposed of as soon as they are detected.

At the present time good "boiling" hens are commanding a fair price, and it would pay many poultry-keepers to go carefully through their flock, handle any doubtful specimens, and cull out birds that are not likely to be profitable. Now while the prices are good it is better to sell birds that are only producing two or three eggs a week.

The poorer birds usually are those that spend a good deal of time on the perches, having slow and sluggish movements, and in many cases the heads are either coarse and fat or long and weak.

Adult Leghorns with yellow legs and beaks at this time of the year may be culled, as it is an indication that they have not been producing for some time. At this period the heavy layers will have pale or more-or-less flesh-coloured legs and beak. The eyes of the poor producer are usually

small, dull, and sunken, with the comb small and shrunken, while with the heavy layer the eyes are generally large, bright, and prominent, and the comb warm and waxy.

When a poor layer is handled it will be noticed that the abdomen is coarse and rather hard, with a layer of fat beneath the skin, the pelvic bones being thick and stiff, whereas with the heavy producer the abdomen will be soft, thin, and pliable like the udder of a good-milking cow, and the pelvic bones thin and pliable

The vent of the non-producer is usually small, round, and dry, but with the laying hen it is large and moist If a regular system of culling is practised, both in regard to the old and young stock, the cost of production is reduced and more room is available for the more valuable growing birds.

Marking of Young Stock.

As there is no definite way of telling the age of fowls, it is a wise plan to mark all young stock before they get too old. This is more necessary on a farm where in many cases birds of all ages run together. The usual method of marking chickens is to punch a hole in the web of the foot, which is usually done just after they are hatched and before placing them in the brooders, suitable punches for the purpose being obtainable at a small cost Fifteen separate or different markings can be made in this way, and a register kept of the different strains.

For marking farm flocks a good idea is to procure a supply of pig-rings, nip the sharp points off, and place one on, for instance, the left leg of all birds hatched this season, and then next season's can be marked on the right leg, which will enable the older birds to be picked out without difficulty when the time comes for selecting the breeding-stock and culling those past the age of usefulness.

Broody Hens.

As this is the time of the year when broody hens are most plentiful it is wise to visit the poultry-houses each night and remove to "broody" coops any hens found on the nests If this is done regularly and all hens removed from the nests when they show the first signs of broodiness, in most cases the broodiness is put off in three or four days; but if the hens are allowed to sit on the nests for two or three nights it takes much longer to break the desire to sit, with the result that there is a greater loss in egg-production. While hens are in the broody coop they should be supplied with ample food and water Cases have been known where such hens are more or less allowed to starve, but this is a mistake, as the object should be to encourage them to lay again as soon as possible, and this can best be assisted by treating them well while in the "broody" coops. An illustration of a good style of "broody" coop is shown in this Department's Bulletin No. 66, "Utility Poultry-keeping," and measures 6 ft. long, 2 ft. high in front, and 19 in. at the back, being divided into three compartments. The floor is of ½ in. wire-netting, the sides having ¾ in. netting, and is 8 in. from the ground. The roof and back are covered with waterproof material.

Green Feed.

Though the fowl-pens may contain grass, in many cases, owing to being over-run with poultry, the green stuff will be contaminated and hardly fit to eat. In such cases fresh green feed should be supplied each day. Some poultry-keepers fail to realize the importance of a regular and liberal supply of green feed for their poultry. It is a fowl's natural tonic and has much influence on the development of young stock. When one sees hens that have not laid an egg during the winter months brighten up in comb and begin to lay when spring returns with its natural supply of green feed, and geese gather their living, lay eggs, and rear their young on young succulent green stuff, one must realize the importance of this item of food in the securing of the best results.

Where poultry are kept in limited areas and have only very small yards in which to run such yards soon become tainted and stale. In many such cases it would pay the poultry-keeper better if he were to keep his birds on the intensive system (provided he allowed each bird at least 4 square feet floor space). The small run could then be used for growing a rotation of green feed, which could be fed to the birds each day.

About one-third of the entire ration for poultry may consist of green stuff, but it is not sufficient to give quantity, as quality is also needed, and green material should be fed in such a way that it will be most relished by the birds. Silver beet, kale, rape, chou mollier, young green oats, Cape barley, and water-cress are all good. Carrots, swedes, and mangels are amongst the best of the roots, and can be fed when other green feed cannot be had. A patch of lucerne, if it can be established, proves a valuable asset on a poultry plant, as it continues to grow for years and to produce heavy yields of green feed from early spring until about April; it may also be made into hay and chaffed for winter use.

Hens that have not been supplied with sufficient succulent green feed usually produce eggs containing very pale yolks. The offspring from birds that have been short of green feed may show signs of deficiency, such as leg-weakness, toe-picking, cannibalism, feather-pulling, or crooked beak-bones, and it therefore pays poultry-keepers to see that their birds are supplied regularly with a good variety of succulent green feed.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Requeening.

THE most important bee within the hive is the queen, and it is futile to expect a colony to be productive unless the queen is a good one. It therefore is highly essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding - queens, and others retained on account of desirable drones.

Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year. If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei, young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. It has been proved that in New Zealand the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming-period. There is practically no risk of robbing; the young queens are readily accepted and tend to reduce swarming. Moreover, a queen introduced during the months of prosperity produces numbers of young bees for the winter, and still is fairly young in the following spring. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming-influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy method of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance then is contracted, and a few vigorous puffs of smoke are forced in through it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke. The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

Extracting Preparations and Practice.

Preparations for extracting the honey must now be well in hand. By the time these notes are published the main flow should have started in the North, but this depends entirely upon weather conditions. In the South the flow is fully three weeks later, and extracting rarely commences before the New Year.

It is well to have all the arrangements for handling the crop completed before the honey is sealed and ready for the extractor. It does not take a great deal of time to prepare extra supers and frames, but these are of inestimable value to the beekeeper when the main flow commences. Every year immense quantities of honey are lost through lack of proper equipment for handling the crop, or through the unreadiness of the beekeeper when the hives are full of honey It is poor economy to keep one's supply so low that the bees remain outside the hive and loaf for want of combs in which to store the honey.

Room should be provided for the workers as soon as the first honey is capped, either by extracting the combs or by supplying another super. Keeping the extractor running from the beginning of the honey-flow till the end is good beekeeping, provided the honey is not extracted while in an unripe condition. Although some authorities advocate leaving all the honey until the end of the season, thereby building colonies three and four stories high, the result is rather heavy work, and in any case, this method is not advisable in southern localities. Where the summer is short and variable the risk of the honey becoming chilled by its being left in the hives until the end of the season is too great. Honey, except in a few instances, is best extracted when warm, in fact, where there is any tendency to "thick" honey, extracting while the honey is warm is the only way to obviate breaking the combs in the extractor.

Comb-honey should be treated in the same way. All sections should be removed from the hives as soon as they are filled. This makes them less liable to be daubed with the propolis and to become "travel-stained" by the constant passage of the bees.

The extractor, tank, and all the rest of the gear connected with the handling of honey should be scalded and thoroughly dried before commencing the season's work. Honey, by reason of its peculiar method of production, does not call for the daily cleansing required by other foods, but it behoves the beekeeper to see that his honey-house is as trim as hands can make it. After the extractor has been scalded it should be kept covered with a clean washing-cover when not in actual use, and every receptacle containing honey should receive the same treatment. These covers are easily made and washed, are inexpensive, and add much to the condition of honey as an article of food. No bees, flies, or any extraneous matter should be allowed to touch the honey once it leaves the extractor, and from the time the bees gather it till it leaves the beekeeper's hands for market his aim should be to produce a dainty and attractive article of food.

Extracting-appliances.

It is most inadvisable to try to work bees profitably without proper appliances. These consist of an extractor, uncapping-knives, uncapping-can, and settling-tanks. Many beekeepers make the mistake of trying to get along with any make-shifts, but experience teaches that it is a poor policy to endeavour to operate without an up-to-date equipment. However small the number of hives kept, if extracting is the objective it is most profitable to install a four-frame machine. Costing a little more at the initial outlay, it soon pays for itself in labour-saving and enables the beekeeper to meet the biggest flow. In any case, he should not be persuaded to purchase a machine that does not reverse. Fixed machines are labour-makers, besides being messy in working. When fifty or more colonies are worked a power-plant pays for itself over and over again.

Second in importance is a good tank. No apiary equipment is complete without one or two good tanks. Too little attention is paid to maturing the honey when out of the hive and freeing it from the minute particles of wax which float on its surface. It must be left to the beekeeper to decide the size of tank he requires, this depending on his needs and conveniences.

For rapid working two ordinary uncapping-knives are very convenient, but as yet no better invention has been given to the beekeeping world than the steam-heated knife. This knife obviates the necessity of constantly dipping the cold knives into hot water, and the work of uncapping can proceed uninterruptedly. There are several uncapping-cans and melters on the market, most of which are relatively satisfactory, but the perfect capping-melter has yet to be invented.

Treatment of Disease.

If the weather conditions have not been favourable for the treatment of foul-brood, this should be undertaken when the first opportunity occurs. One should not delay until the main flow arrives. It is well to remember that if colonies are treated early enough a surplus of honey is secured and the expense of treatment recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Full particulars of the treatment of foul-brood are given in Bulletin No. 119, "American Foul-brood and its Treatment," which may be obtained free from the Department of Agriculture, Wellington, or from the Apiary Instructor in each centre.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

LAND from which crops of early potatoes, peas, and salads are harvested is now cleaned up and planted with winter crops. If the preparation for the previous crops was liberal and thorough, light cultivation is all that is necessary now before planting. Leeks, kale, broccoli, Brussel's sprouts, and savoys are suitable for the cooler districts. In warmer localities cauliflowers, which have the advantage of maturing quickly, may be planted in preference to broccoli. On land that is moist but well-drained self-blanching varieties of celery may be planted out 9 in. apart in long beds 2 yards or 3 yards wide, with the surface at ordinary levels. In drier localities and on land that is over-drained it is necessary to plant celery in trenches, which facilitate frequent irrigation. As rather long periods of dry weather are often experienced at this season it is necessary to plant out these crops with considerable care, choosing dull weather, before rain, for the work. The seed-beds should be soaked well the day before lifting the plants, which should be taken up carefully, as required, and placed in trays. They should not be exposed to sun and wind. In the field the plants should be set low and

watered at planting. To prevent the attack of caterpillars during the present stage of growth an application of a dust composed of one part arsenate of lead-powder thoroughly mixed with five parts of hydrated lime is effective if applied during the evening, or in the early morning when the foliage is damp. Chiefly, plants of the cabbage family require this attention. To prevent aphides becoming established and destroying the central bud, which sometimes happens to cabbage-plants, a pinch of tobacco-dust is effective. Leeks have few troubles to contend with, but the celery crop requires to be kept under close supervision for leaf-spot fungus attacks, and usually requires occasional applications of Bordeaux 3–4–50 to prevent this. The lime ingredient in this mixture may be replaced by washing-soda, using sufficient to make a neutral mixture. A large number of moderate-sized specimens of good texture and flavour should be the object in the production of these crops; over-sized specimens without much quality are sometimes commended, but they compare unfavourably when it somes to practical use.

During dry periods runner beans often fail to set the pods satisfactorily, and then a light spraying with clean water after sunset is beneficial. Those planted against walls and fences are most likely to suffer in this way. In such a position the roots also are likely to lack moisture owing to the limited rainfall which reaches them; a good soaking occasionally and a mulch of dry litter on the surface of the ground usually supply their needs in this respect. Marrows and other gourds are also seriously affected by a lack of moisture and require attention during dry periods. Marrows are at their best when cut small before they ripen: the vines also are more productive under this treatment.

Further sowings that might be considered during the month of December are dwarf beans, peas, shorthorn carrots, and lettuce sown thinly to mature where sown; radishes and quick-maturing white turnips.

A cleansing fallow for weedy ground requires close attention now to take full advantage of dry periods, if this is done clean ground and a good autumn crop are the probable rewards.

Early in the month of December most of the plants forming the rough growth in odd corners and hedge bottoms are in flower and in suitable condition for mowing. They should be cut close with a weed-scythe and allowed to lie on the ground as a mulch.

Small Fruits.

A most serious fault in fruit-packing is to pack specimens of mixed stages of maturity in one parcel—this is avoided chiefly by clean picking so that no over-ripe specimens are available to stain and spoil the appearance of the pack. Honest packing and an appetizing appearance are important factors in selling these products. Difficulties are more likely to arise in the harvesting and marketing of strawberries than of any other of the small fruits. Packing of stawberries is done by the picker as the fruits are gathered, and one who is inexperienced will rather naturally "face" a pack to give it good appearance; and so long as this consists of a neat arrangement of the surface fruit in the punnet it is quite legitimate and desirable, but the size and quality of the fruit should be similar to that which is below. Clean punnets well filled with fruit of an even grade are always in good demand. Berries that are undersized, misshapen, or over-ripe must be placed in a separate receptacle and are suitable for culinary use. Firm fruit only should be consigned for long distances; specially is this precaution necessary during hot weather. Strawberries are picked with a short stem attached, raspberries and loganberries are removed from the plug, and currants are "strigged" when gathering the ripe fruit. To enable it to retain a bright, fresh appearance that is so desirable the fruit should be dry and cool when gathered and always given cool conditions until consumed. The close-stacking of large bulks and delay in collecting packed punnets in the field

are likely causes of heating. Furthermore, it always is to be remembered that these goods are perishable, even when all precautions are taken, so that it should be always a rule to market the fruit on the day it is gathered.

Weak and surplus suckers on raspberries and loganberries should be suppressed: this has the effect of invigorating and ripening those new growths retained for cropping next season.

Identification of Raspberry Varieties.

The best varieties of raspberries have outstanding qualities, and when the fruit of a variety is unmixed with others it can be used to best advantage and crop-management is facilitated. The confusion which exists in the identification of many varieties of raspberries is being tackled by the staff of the Horticultural Research Station, Long Ashton, Bristol, who have had a long experience of variety trials with fruit of this kind.

In a recent report the following key for variety identification is presented,—

(1) *Mature Cane Colour*.—The varieties are first divided into three colour-groups according to the colour of the mature canes: Red, light brown, and white.

(2) *Colour of the Spines on Young Canes*.—Only canes that have made one foot or more of growth can be regarded as reliable when comparing spine-colour. Spines are defined as dark or pale in colour. During winter the only feature by which varieties can be grouped is mature cane-colour, but for a period during the summer season this character can be used in conjunction with the spine-colour on growing canes. In this connection it is interesting to see the spineless variety Northumberland Fillbasket is classified with white cane, pale spine varieties.

Other distinguishing characters are—*Canes*, which may be dwarf or medium-vigorous; erect or spreading. *Leaves*: Colour-shade and habit are noted. *Fruit*: Season, shape, colour, and flavour are the outstanding points.

For instance, the variety Semper Fidelis is described as—(1) Mature canes, red; (2) spine-colour, dark. *Canes* of medium vigour, spreading. *Leaves* medium-dark green, fairly flat. *Fruit*: Mid-season, medium size, conical, deep red, sharp flavour. Also the variety Lloyd George—(1) Mature canes, white; (2) spine-colour, dark. *Canes* vigorous, spreading. *Leaves* somewhat shiny, medium-dark green. *Fruit* early, large conical, fairly firm, variable colour, moderate flavour.

This key to varieties is simple and practical and cannot fail to be of value to growers of raspberries.

The Homestead Garden.

To fully exploit conditions of soil, climate, &c., with a minimum of labour and most effect, the extent of the garden should be proportioned to the size of the homestead, and the design should be compact, with each section well organized. The formality of many old-fashioned gardens has been severely criticized. Where it was extreme and extensive, as sometimes happened, it could certainly become very tiresome. However, there is another extreme of which there are too many examples here: it is an informal rustic style that can only be described as chaotic. Whatever opinion one may have about it, the main point is that the labour of maintenance of such a garden is very great. Good results, requiring the least amount of labour for maintenance, may be obtained by planning a simple, well-proportioned design in which vegetable and fruit garden, shrubberies, and herbaceous borders have each their well-defined limits. And the latter—that is, the shrubberies and herbaceous borders—are planted with rather large groups of each kind of plant. A desirable amount of informality is

obtained by adding one or two specimen trees or detached groups of herbaceous plants or shrubs. In such a garden unskilled labour may be used to advantage and with little danger of damage being done.

Making new gardens or alterations to old ones is best done during the autumn or spring, hence the present time is most suitable for planning the work, the quality of which depends very much on the previous consideration given to it. It is best planned in detail, and, if to scale, the work, when it comes to be done, is greatly facilitated

The most difficult, and perhaps the most interesting, feature in the work is the selection and arrangement of the trees, shrubs, and plants. This is successful—that is, effective and economical—when the plants are quite suited to their environment, as regards climate especially Whether it be humid or dry, cold or warm, shaded or sunny, sheltered or exposed to winds, there is a very varied plant association suited to each condition, and one is wise to exercise personal preferences within that group. In most districts this has been thoroughly well demonstrated now, and careful observation in established public and private gardens in one's vicinity, or in similar country, will afford the necessary information One principle which is generally endorsed, but frequently forgotten in practice, is that the background and many of the outstanding features in the garden should consist of native plants For the former purpose our native evergreen trees and shrubs cannot be excelled, while for the latter our tree-ferns, nikau palms, cabbage-trees, lancewood, and flowering trees and shrubs cannot be ignored In a warm locality on the coast even in an exposed position, the karakas and pohutukawas almost alone would furnish a small garden handsomely if suitably arranged There is nothing finer than these, in their class

About the verge of established plantations and among the young trees in new ones, at the foot of hedges and in odd corners where high grass and herbage has grown, it should be carefully mown now and allowed to lie as a mulch. It not only improves the appearance of the property, but increases fertility, lessens the danger from fire, and its cutting is of great assistance to young plants and hedges by admitting more light.

—*W C Hyde, Horticulturist, Wellington.*

NORTH ISLAND LAMBING ESTIMATE.

From information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 83·68 per cent, compared with 89·88 per cent in 1934 With 9,697,231 breeding-ewes in the North Island, as shown in the 1935 sheep returns, the number of lambs this season is estimated at 8,114,361 South Island and Dominion returns will be given in next month's issue of the *Journal*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF GROWTHS ON SKIN OF HEIFERS.

A. R. H., Waiuku :—

A heifer has large wart-like growths on its body, particularly on its head and flanks, and another heifer has small warts on its neck. The heifers seem to be quite healthy otherwise and are thriving as well as their mates.

The Live-stock Division :—

Warts in young animals usually disappear without anything being done to them, but larger warts may require to be cut out. You may be mistaking ringworm for warts. Dressing each spot with a swab saturated with kerosene, Jeyes fluid, or Camfosa will kill the ringworm. It is advisable to be careful that none of the strong application gets into the eyes; one application is usually effective. An alternative treatment is to wash them with a fairly strong solution of sheep-dip, according to the instructions on the label. If it is not desired to adopt the above treatments the following can be used: Sulphur and olive-oil, or sweet-oil, or, in the absence of these, raw linseed-oil will do Take 1½ oz. of sulphur (flowers of sulphur) to 1 pint of oil, work it into an emulsion and shake well, and add 2 tablespoonsful of kerosene. This may be applied every fourth day.

SPECIAL FEED FOR EWES IN SPRING.

F. J. F., Ohura :—

Please advise the value of rye-corn as a supplementary feed for ewes during August and September; when it should be sown; amount that should be sown per acre (broadcast); and the kind and quantity of manure necessary.

The Fields Division :—

Whether the growing of catch-crop cereals for spring feeding of ewes is worth while depends on many circumstances; under general farming conditions the feed for this period is best supplied by top-dressed rye-grass pastures, and a pasture-improvement programme is probably the best means of improving the spring feed position If special crops are grown, Algerian oats, Algerian oats and Italian rye-grass, black skinless barley, or black skinless barley and Italian rye-grass are better than rye-corn. These crops should be sown in March or April for feeding in July, August, or September. It is advisable to sow 4 bushels of either oats or barley alone, or 3 bushels of oats or barley and 15 lb. Italian rye-grass with 3 cwt. superphosphate.

TESTS FOR CONTAMINATION OF MILK.

H. B. I., Norsewood :—

Is there any simple method whereby I could test milk for contamination by, for instance, using a sample from the holding-vat before separating?

The Live-stock Division :—

Milk can best be tested for the presence of dirt by use of a so-called sediment tester. This is an instrument by means of which a pint of the milk to be tested is forced through a small round pad. The pad retains any dirt present so that it can readily be seen. The Methylene blue test gives an indication of bacterial contamination, and this, indirectly, provides an indication of the amount of dirt contamination.

WEATHER RECORDS: OCTOBER, 1935.

Dominion Meteorological Office.

NOTES FOR OCTOBER.

OCTOBER can be regarded as having been a favourable spring month, the main features of which were the generally mild temperatures and a plentiful rainfall, especially in the last ten days. The rain in South Canterbury relieved the fear of severe loss through the prolonged dry weather, and by the close of the month crops and pastures had made a good recovery in that district Over the greater part of the Dominion there was a vigorous growth of vegetation, and consequently stock are in splendid condition and dairy production has increased appreciably.

Rainfall—The total rainfall was above the average over most of the North Island, but below in the northern part of the Auckland Peninsula and at a few isolated places in the Gisborne, Hawke's Bay, and Taranaki districts. In the South Island an excess was recorded north of Greymouth and Akaroa, while farther south there was a deficiency

Temperature—Temperatures were nearly everywhere above the average, although the departure was nowhere a great one. In the coastal area between Wellington City and New Plymouth and at Invercargill it was very slightly below, while in North Canterbury it did not vary much from the average. Christchurch experienced a frost of 9 degrees on the morning of the 20th and one of 8 degrees on the 16th, but otherwise there were no severe frosts during the month, many districts reporting none at all.

Sunshine—Owing to a considerable amount of dull weather during the latter part of the month, sunshine was less than the average in most districts, the only excess being experienced in North Auckland, the east coast districts south from Christchurch, and in Southland.

Pressure Systems.—Up till the 13th, although temporary changes to south-westerly occurred in places, the winds were mainly north-westerly or westerly. What little rain fell during this period was confined mostly to the western and far southern parts of the South Island, the weather remaining fair and warm in all eastern areas

During the night of the 13th a rather deep depression crossed the Dominion, and by the morning of the 14th winds had become south-westerly or southerly generally, rain accompanying the change in most districts, with a drop in temperature. The rainfall was only light and scattered in most of the eastern districts. A slight secondary which crossed the central portion of the North Island on the 16th was responsible for thunder and hail at places between Taranaki and the East Coast district of the North Island. During the next two days, while an anti-cyclone was crossing the Dominion, fine weather prevailed generally.

On the 19th a southerly change in the night brought rain, though chiefly light falls, to most districts.

The morning of the 20th was marked by an improvement setting in generally. The 21st was a brilliantly fine day over most of the Dominion, but by the morning of the 22nd an extensive and complex depression was approaching from the westward. The latter was the most important depression of the month as it was responsible for warm, beneficial rains throughout the Dominion during the night of the 22nd and from the 23rd to the 26th. Improved conditions were in evidence on the 27th. On the 28th conditions became unsettled in western areas, with scattered rain. By the morning of the 29th this disturbance had greatly intensified and its centre was located east of the South Island. It had passed beyond effective range on the 30th, but a new cyclonic depression had moved from the north-west on to the North Island. Dull, misty weather prevailed on the last two days, heavy rains occurring in the North Island and parts of the East Coast districts of the South Island.

RAINFALLS FOR OCTOBER, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches		Inches.	Inches.	Inches.	Inches.
Kaitaia	4·66	15	1·48	5·27	61·89	48·93
Russell	3·03	7	1·66	3·98	85·47	45·17
Whangarei	2·92	17	0·71	4·76	73·10	54·71
Auckland	4·12	17	0·87	4·06	54·71	42·58
Hamilton	5·38	16	1·70	4·00	42·07	42·03
Rotorua	5·24	18	1·18	5·19	60·09	47·10
Kawhia	5·56	13	1·20	5·15	..	45·90
New Plymouth ..	7·18	20	1·36	5·46	67·64	50·79
Riversdale, Inglewood ..	14·28	22	3·47	10·41	103·63	87·57
Whangamomona ..	12·34	17	3·01	8·43	75·31	64·53
Hawera	4·11	16	0·98	4·65	50·36	38·18
Tairua	5·32	12	1·75	5·81	67·11	56·44
Tauranga	6·11	19	2·42	5·11	57·19	45·52
Maraehako Station, Opotiki	6·48	12	3·06	5·35	64·19	47·29
Gisborne .. .	2·40	12	0·84	2·67	41·07	39·95
Taupo	4·65	17	1·15	4·31	46·46	37·43
Napier	3·55	14	1·46	1·89	46·43	26·12
Hastings	1·59	12	0·38	2·11	36·13	28·16
Whakarara Station ..	4·38	7	0·86	..	56·61	..
Taihape	3·47	19	0·58	3·50	31·64	30·06
Masterton	4·28	18	0·59	3·24	40·00	32·78
Patea ..	5·87	17	1·08	4·25	49·69	37·28
Wanganui	6·32	17	1·44	3·46	38·42	30·18
Foxton	4·77	16	1·00	2·94	32·33	26·67
Wellington	5·12	18	0·85	3·51	34·81	36·38
			South Island.			
Westport	10·00	20	1·56	8·70	76·77	88·35
Greymouth	9·12	19	1·60	10·74	80·93	83·90
Hokitika	8·58	20	1·48	11·81	91·30	94·12
Ross	8·75	15	2·00	14·77	95·64	109·48
Arthur's Pass ..	14·24	17	3·00	20·33	108·97	131·69
Okuru, South Westland	9·46	12	2·05	15·21	87·33	120·90
Collingwood	17·67	19	5·94	10·08	88·38	82·03
Nelson	6·04	13	2·78	3·50	41·13	31·94
Spring Creek, Blenheim	2·60	13	0·65	2·56	24·71	25·79
Seddon	3·59	15	0·84	2·23	19·97	20·99
Hanmer Springs ..	5·90	13	1·13	3·92	36·03	37·83
Highfield, Waiau ..	5·03	11	2·20	2·60	27·01	28·12
Gore Bay	4·19	9	0·91	2·33	22·75	26·58
Christchurch	2·90	11	0·84	1·97	18·67	20·89
Timaru	1·62	7	0·64	1·98	15·81	18·31
Lambrook Station, Fairlie	2·26	10	0·72	2·06	17·31	20·37
Benmore Station, Clearburn	2·52	11	0·84	2·30	18·21	20·25
Oamaru	1·77	10	0·81	1·76	15·80	17·84
Queenstown	2·03	11	1·12	3·31	25·52	25·28
Clyde	0·83	6	0·26	1·62	12·59	12·12
Dunedin	2·74	9	1·42	3·09	29·91	29·97
Wendon	1·24	9	0·38	2·73	26·37	24·42
Balclutha	1·45	12	0·35	2·42	25·85	20·58
Invercargill	2·00	20	0·41	4·35	39·16	37·37
Puysegur Point ..	7·37	28	1·30	8·13	72·39	69·84
Half-moon Bay ..	7·47	23	2·55	5·16	50·80	48·10

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APPLICATION OF ORCHARD-SPRAYS.

1. THE STATIONARY SYSTEM.

G G TAYLOR, Mycological Laboratory, Plant Research Station, Palmerston North.

THE stationary system of spraying orchards was first used in America in 1907 (Moses and Duruz, 1926), where it was developed in response to the need for a more rapid and economical method of spraying than was possible with portable outfits. It was not adopted in New Zealand, however, until 1925, in which year it was introduced in the Nelson and Hawke's Bay Districts The advantages of the system were realized quickly, with the result that to-day it is used widely throughout the fruitgrowing centres of the Dominion.

The essential feature of this system is that the orchard is reticulated with pipes through which the spray is driven from a central pumping-station. Taps are situated at convenient positions along the pipes, and the orchard is sprayed in blocks by attaching a hose to each of these taps in turn. Thus the stationary system consists of two distinct sections (*a*) the piping-system and (*b*) the pumping-station In the following pages piping-systems are discussed, pumping-stations being dealt with in a subsequent paper

The Piping-system.

For successful spraying by the stationary method it is necessary (1) that the piping-system be carefully planned, (2) that the pipes be properly installed, and (3) that subsequent care and management be such that maximum efficiency is maintained.

PLAN OF RETICULATION.

Orchards vary so greatly in size and shape, spacing between trees, distribution of varieties, &c. that no single plan of reticulation is applicable to all. There are, however, two factors pressure-loss and convenience of working—which influence the reticulation suitable for any particular orchard.

Pressure-loss is caused by frictional resistance to the flow of spray in the pipes. If this is excessive, then either the pump must be run at very high pressure or else insufficient pressure is obtained at the nozzles for efficient mist-production. Pressure-loss is increased by increase in the rate of flow, decrease in the size—*i.e.*, internal diameter—or increase in the length of pipes, alterations in direction by angles

bends, &c., and by internal roughness. In planning the piping-system these factors should be considered with a view to reducing pressure-loss to a minimum.

Convenience of working involves consideration of the plan of reticulation as it affects subsequent spraying operations. A number of factors are significant in this respect, such as the number of trees sprayed from each tap, relationship of the piping-system to different varieties, &c.

TYPE OF RETICULATION.

When the stationary system was first introduced in New Zealand two types—the dead-end and the circulating system—were used.

Pipes of the dead-end system (Figs. 1, 2, and 3) consist of mains running through the greatest length of the orchard and laterals carrying stand pipes and taps. When the pump is delivering more spray than is required at the nozzles the surplus is returned through a release valve directly to the mixing-tanks.

In the circulating system (Fig. 4) a continuation of the main returns excess spray to the mixing-tanks. The high velocity of spray maintained in the mains of this type of layout was considered necessary to prevent sedimentation of spray solids. Experience has shown, however, that where spray materials of fine-particle size are used the velocity of liquid in the dead-end system is sufficient to prevent sedimentation.

Since the circulating system requires more pipe and causes greater pressure-loss, due to the high velocity of spray in the mains, it has been abandoned in New Zealand in favour of the dead-end system.

LOCATION OF PIPES.

Overhead.—The method adopted in this case is either to utilize the trees for carrying the pipes or to provide upright supports. Neither is satisfactory, for the pipes tend to sag between the supports, causing uneven flow of spray and consequently increased pressure-loss. Further, in this position the pipes hamper picking and spraying operations.

On the Surface.—Temporary systems, in which pipes are laid out each time the trees are sprayed, have been used overseas. In New Zealand, however, surface-laid pipes have not been adopted, since temporary systems would prove too wasteful of time and permanent pipes would interfere with routine orchard operations.

Underground.—The underground position has been found most convenient, for the pipes do not interfere with general orchard work, and if properly laid and regularly washed after spraying require little attention.

LAYOUT OF PIPES.

The layout of pipes for any orchard is influenced by the following factors :—

Location of the Pumping-station.—In all cases the ideal location for the pumping-station is in the centre of the orchard. In this position pressure-loss is reduced, since the greatest distance from the pump is as short as possible and the nozzle-men can be separated so that they do not all work from the same main (Figs. 1, 2, and 5). In

some cases, however, convenience of working may justify locating the pumping-station at one side. For example, such a position would not materially increase pressure-loss in a long narrow orchard (Fig. 3). A similar position might also be adopted in orchards smaller than 10 acres where pressure-loss is not so significant.

Direction of the Mains.– The general layout should be such that the mains bisect the orchard along the longest axes—*e.g.*, Figs. 1 and 2.

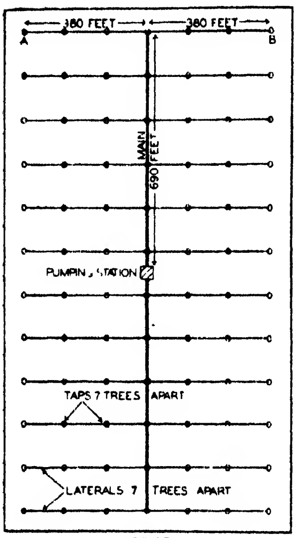


FIGURE 1

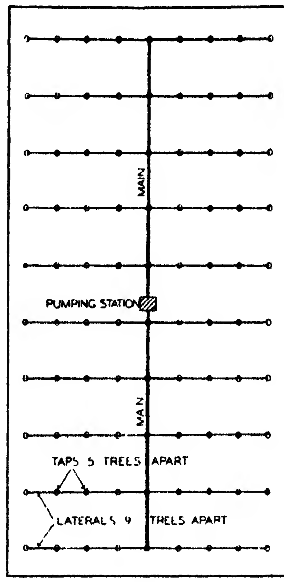


FIGURE 2

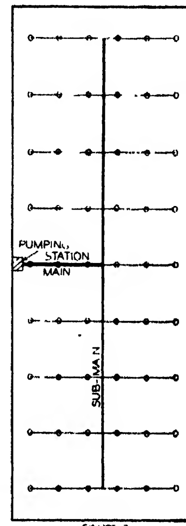


FIGURE 3

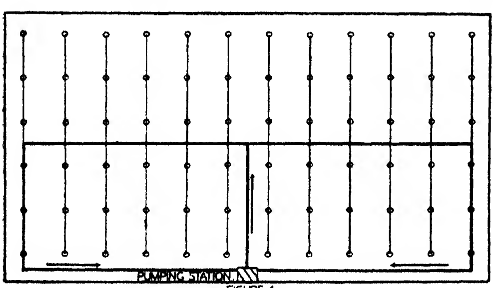


FIGURE 4

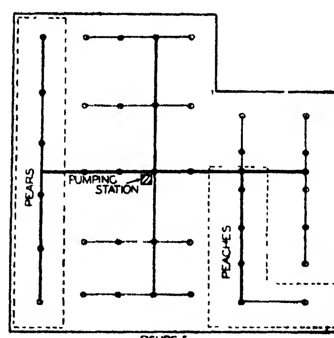
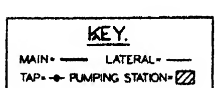


FIGURE 5



This ensures that laterals are short, thus reducing pressure-loss, since it is in the smaller lateral pipes that frictional resistance is greatest. Further, with short lateral pipes no more than one man need spray from the same lateral.

Where the pumping-station is at the side, one main should run to the centre of the orchard, with submains running along the longest axes (Fig. 3).

Spacing between Laterals.—Two methods of piping are in common use—the square and the oblong—depending on the shape of the blocks of trees sprayed from each tap. The spacing between laterals is determined by the method adopted and by the number of trees in each block. In both methods it is usual to place the tap close to the centre tree of each block so that the same number of trees can be reached from each side of the tap. With this arrangement there are necessarily an odd number of trees along each side of the block.

In the square system (Fig. 1) there are seven trees by seven trees in each block, the laterals being spaced seven trees apart. Larger blocks are not advisable, since the length of hose becomes too great to handle efficiently, while smaller blocks have the disadvantage that more frequent changes from tap to tap are required. This applies to orchards where the trees are spaced 18 ft. apart or less. Where the spacing is greater than 18 ft. it is advisable to have blocks five trees by five trees, in which case the laterals will be five trees apart.

In the oblong system (Fig. 2) there are five trees by nine trees in each block, and laterals are spaced nine trees apart. Blocks of trees five by eleven are sometimes used, but the increased length of hose required is too cumbersome for efficient working. Where the spacing between trees is greater than 18 ft. it may be advisable to utilize blocks of trees five by seven with laterals spaced seven trees apart

Of these two methods the oblong system appears to be preferable, since the greater distance between laterals reduces the total length of pipe required and the blocks of trees are easier to spray (see Management).

Distribution of Varieties.—There are usually several varieties of trees in a commercial orchard, and, owing to variations in time of blossoming, susceptibility to spray injury, &c., it is usually necessary to differentiate between varieties when spraying. Thus the piping-system should be planned in relation to those varieties which are likely to require particular spray treatments, otherwise it may be found that frequent changes from one tap to another are required and that considerable lengths of pipe have to be filled in order to spray a few trees.

Varieties requiring particular treatment may be served by introducing additional laterals or by the use of an additional main if one variety runs through the length of the orchard (Fig. 5).

Where a few trees which cannot be sprayed with the main varieties are scattered through the orchard, it is advisable to work them over to a more convenient variety.

SIZE OF PIPES.

The size of pipes (nominal internal diameter) is determined by pressure-loss, cost, and risk of sedimentation. By increasing pipe-size pressure-loss is reduced, but cost of installation is increased and the risk of sedimentation becomes greater. Under practical conditions, therefore, the size of pipes should be large enough to prevent excessive pressure-loss without involving high cost or risk of sedimentation.

Many of the systems in New Zealand have been installed with pipes which are too small in size, measurements showing that under average conditions pressure-loss may exceed 200 lb., and when the nozzle-men are working from the laterals most distant from the pump it may be

greater than 300 lb. By the use of larger pipes maximum pressure-loss can be reduced to 150 lb or less without the cost of such pipes becoming excessive or the velocity of spray being reduced sufficiently to cause sedimentation.

In determining the size of pipes which will keep the maximum pressure-loss below 150 lb. the significant factors are the velocity of spray in the pipes and the extent of the piping-system. The velocity or rate of flow is determined by the volume of spray delivered in gallons per minute at the nozzles. For each nozzle (or combination of nozzles) a volume delivery of 3 gallons per minute should be allowed.* From this the maximum velocity in the mains can be calculated by allowing 3 gallons per minute for each nozzle supplied. In the laterals the maximum velocity is 3 gallons per minute, since more than one man should not spray from the same lateral. Table 1 indicates the approximate pressure-loss which is likely to occur under orchard conditions with various sizes of pipes and different rates of flow. Pipe size can be calculated from this table by adjusting the size of mains and laterals so that the maximum pressure-loss is approximately 150 lb. when all the nozzle-men are working on the laterals most distant from the pump. In some cases it may be found unnecessary for all the nozzle-men to work from the same main, in which case the different mains should be treated as separate units and calculations made accordingly.

Table 1. Approximate Pressure-loss in Pounds per Square Inch, per 100 ft of Pipe *

Rate of Flow, in Gallons, per Minute	½ in. Pipe	¾ in Pipe	1 in Pipe	1¼ in Pipe.
	lb.	lb.	lb.	lb.
3	26	8	..	..
6	..	25	8	2
9	..	52	17	4

* This table is based on measurements taken under working-conditions and includes pressure-loss due to angles, bends, &c.

The use of Table 1 is illustrated as follows: In the piping-system shown in Fig. 1 the length of each main is 690 ft. and each lateral 380 ft. With two men spraying, maximum pressure-loss is experienced when they are working from the taps marked A and B. Allowing a volume delivery of 3 gallons per minute for each nozzle, the rate of flow in the main would be 6 gallons per minute and in each lateral 3 gallons per minute. If ¾ in. mains and ½ in. laterals are used the pressure-loss in the main would be approximately 173 lb. and in the laterals 100 lb., making a maximum pressure-loss of 273 lb. in driving spray to each nozzle. Therefore larger-sized pipes than these are required to reduce the loss to about 150 lb By substituting 1 in. pipe for the mains the maximum pressure-loss would be approximately 154 lb.

The usual size for laterals is ½ in., but if they are particularly long or far removed from the pumping-station they should be of ¾ in. pipe. Where the mains are short or the velocity of spray is low ¾ in. pipe may

* This figure is based on experimental evidence, which will be published in a later paper dealing with spray coverage.

be sufficient, but if the mains are long or the rate of flow is high they should consist partly or wholly of 1 in. pipe. For extensive systems it may be necessary to use $1\frac{1}{4}$ in. mains for part of the system.

ACCESSORY APPARATUS.

Valves.—It is advisable to fit a gate-valve on each main close to the pumping-station to shut off sections of the system not in use.

High-pressure taps are used to shut off the flow of spray to the nozzles and to provide attachment for the hose-coupling. These taps are screwed into sockets placed on top of stand-pipes, the latter being connected to the laterals by short underground leads.

Hose-couplings.—The usual method of attaching the hose to taps is by a screw-coupling. Another method is to use a coupling on the hose which can be clamped on to nipples permanently attached to each tap. The latter type of coupling has the advantage of easy attachment and removal, but is difficult to keep adjusted and is therefore liable to leak under high pressure.

Valves are sometimes used in conjunction with hose-couplings in order to avoid the necessity of releasing pressure at the nozzles before removing the hose, thus saving time and avoiding wastage of spray. Ball-valves are generally employed for this purpose but are unsatisfactory, for the ball does not seat properly until the coupling is partly removed, by which time the operator has become wet with spray. This difficulty can be overcome, however, by the use of small screw-valves instead of ball-valves.

Hoses.—In stationary systems the number of trees which can be sprayed from each tap is limited by the length of hose used. If the hose is too short time is wasted in frequent changes from one tap to another, and if too long it becomes very cumbersome to handle. The maximum length of hose which can be handled efficiently is 120 ft., the actual length required depending on the number of trees to each tap and the spacing between trees.

Two sizes of hose (internal diameter) are commonly used, $\frac{1}{2}$ in. and $\frac{3}{8}$ in. Hoses of the latter size are preferable where volume delivery does not exceed 3 gallons per minute, for although the pressure-loss is slightly greater they are considerably lighter to handle.

INSTALLATION OF PIPES.

The pipes are laid in trenches formed by ploughing furrows and deepening them to from 12 in. to 15 in. For the mains the furrow should lie mid-way between two rows of trees, and for the laterals about 6 ft. from the row of trees to which leads are to be taken for stand pipes and taps.

Pipes are usually supplied in lengths of 20 ft. and these are coupled together with sockets. In joining pipes it is advisable to use bitumistic paint and tow to prevent corrosion and leakage. If all the pipes are connected with sockets it is impossible to remove sections without cutting. Since blockages or leaks may require removal of pipes it is advisable to use running-joints* at intervals throughout the system.

* A running-joint is similar to an ordinary socket joint except that the thread on one piece of pipe is extended far enough to allow the socket to be completely screwed off the companion pipe. The joint is kept tight by a back-nut screwed against packing and the exposed thread painted to prevent corrosion.

Laterals are joined to the mains, and tap-leads to the laterals by tee or cross sockets. Where possible it is advisable to use bends for changing the direction of pipes rather than angle sockets, since with the former there is less pressure-loss.

Stand-pipes are formed by bending the terminal ends of the leads from lateral pipes. They should be as close as possible to the base of their respective trees and extend from 6 in. to 9 in. above the ground. It is advisable to paint them at ground-level to prevent corrosion.

Before covering the pipes the system should be tested to ensure that all the joints are pressure-tight. Finally, an accurate plan of the system should be made marking the exact position of mains laterals, running-joints, and taps.

Care and Management.

In determining pipe-size allowance was made for a maximum pressure-loss of 150 lb. when all nozzle-men were spraying from the laterals most distant from the pump. In practice this maximum should be avoided, as far as possible, by separating the nozzle-men so that they are working from different mains and at varying distances from the pump Whatever arrangement is adopted there are bound to be considerable variations in pressure-loss at different points in the orchard. To obtain relatively constant pressures at the nozzles, adjustment of working-pressure at the pump is required. The amount of adjustment necessary may be ascertained by testing the system at various points with a pressure-gauge inserted between the hose and nozzle.* Necessary adjustments at the pump can then be made during spraying when the nozzle-men reach those positions where tests have been taken.

In spraying the trees from each tap there are two methods of approach. In the first, the operator commences at or near the tap tree, sprays the block of trees in sections so that the hose lies in a diagonal direction when spraying the corner trees, and finishes near to the tap tree (Figs. 6 and 7). The hose is then uncoupled and carried through to the next tap. The second method differs in that the operator commences at one side of the block, sprays the trees in rows, and finishes at the commencement of the next block (Figs. 8 and 9). In this method the operator returns to the tap, uncouples the hose, and pulls the coupling end through to the next tap, the nozzle being left in position for spraying the next block. Both methods vary in detail with nearly every operator, Figs. 6 to 9 serving to illustrate some of the better types in use.

In comparing these two methods it will be seen that the former is complex, involving a large number of turns, while the latter is simple in that long rows of trees are sprayed with a minimum of turns With the complex method it frequently happens that where the continuity of spraying is broken the operator leaves trees unsprayed. There is little likelihood of this happening with the simple method. The complex method is not readily adjusted to variations in the size

* For this purpose a tee socket may be used with a short upright to carry the gauge and adaptors at either end for attaching the hose and nozzle.

or shape of the blocks of trees, whereas the simple method can be readily adapted. In the simple method long rows of trees are sprayed, and this is well suited to the oblong-block method of piping previously discussed. The complex method has the advantage that a shorter length of hose is used to reach the corner trees, thus making the hose lighter to handle. But this is offset in part by the fact that in the complex system the entire hose has to be carried through to the next tap, whereas in the simple method only the coupling end is pulled

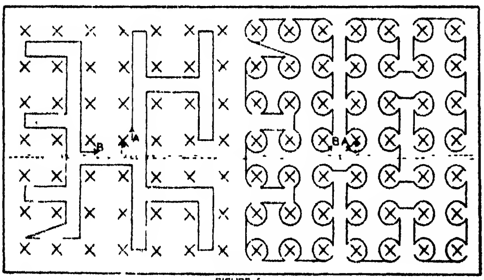


FIGURE 6

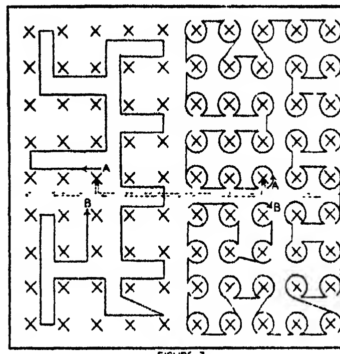


FIGURE 7

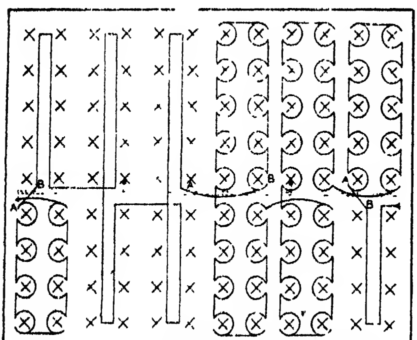


FIGURE 8.

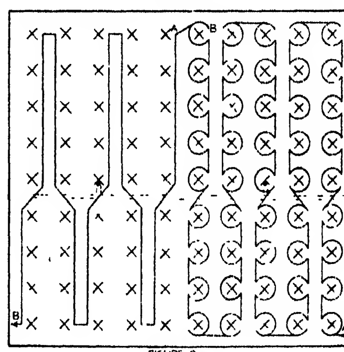
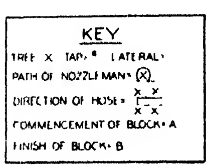


FIGURE 9



through. Thus the simple method of spraying the blocks of trees appears to be the better, that shown in Fig. 9 being one of the most efficient types in use at the present time.

Reports from America (Morris, 1924) and experience in New Zealand indicate that corrosion of pipes is extremely slow. In some instances, however, reduction of internal diameter has been caused by accretion of spray materials. This appears to be due partly to the use of spray materials of coarse particle size or of badly emulsified oils and partly to careless washing of pipes. It is desirable, therefore, to wash the pipes with water after each day's spraying, the taps at the

ends of each lateral being opened in turn to obtain the flushing effect of rapid flow. During winter, pipes should be examined and if deposition of spray material has occurred they should be cleaned. Tests have shown that commercial hydrochloric acid used at a strength of 1 gallon to 19 gallons of water makes an efficient cleaning-agent. After leaving the diluted acid in the pipes for half an hour, water should be pumped through until the acid is removed and all loosened material has been washed out.

With proper care the modern type of spray hose will last for five years or more. Damage is likely to occur where the hose becomes twisted and looped. By care in manipulation the hose can be kept free of loops and the liability of "blow-outs" largely avoided. After spraying is completed the hose should be washed inside and out and hung inside the spraying-shed until next required.

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(To be continued.)

THE OFFICIAL SEED-TESTING STATION.

RECORD OF TESTING OPERATIONS FOR YEAR 1934.

THE number of samples received for testing averages of purity and germination for the various seeds as specified are shown in the following tables, Nos. 1 to 10:—

Table 1.—Origin and Classification of Total Samples, 1934 and 1933.

Origin.	Purity only.		Purity and Germination.		Germination only.		Ultra-violet Light.		Total.
	1934.	1933.	1934.	1933.	1934.	1933.	1934.	1933.	1934.
Seed-merchants	**256**	224	**6,887**	8,058	**4,226**	4,190	**249**	328	**11,618**
Seed-growers and farmers ..	**3**	3	**229**	167	**50**	61	..	33	**282**
Department of Agriculture—									
Fields Division	**13**	12	**119**	123	**130**	67	**16**	50	**278**
State seeds-purchasing ..	..	1	**429**	362	**99**	107	..	..	**528**
Plant Research Station ..	**4**	..	**88**	41	**333**	354	**1,036**	1,399	**1,461**
Seed-testing Station ..	**58**	2	**23**	188	**693**	1,338	**60**	14	**829**
Totals	**329**	242	**7,775**	8,939	**5,531**	6,117	**1,361**	1,824	**14,996**

Table 2.—Number of Commercial Samples from Land Districts and Centres therein, 1934 and 1933.

South Island.	1934.	1933.	North Island.	1934.	1933.
Southland (total) ..	**2,942**	2,887	Wellington (total) ..	**2,948**	3,327
Gore	**1,042**	1,608	City	**1,541**	1,502
Invercargill ..	**1,652**	1,219	Palmerston North and Feilding	**1,006**	1,420
Other	**248**	60	Other	**396**	405
Otago (total) ..	**928**	1,225	Hawke's Bay ..	**873**	903
Dunedin	**829**	1,010	Poverty Bay ..	**280**	360
Other	**99**	215	Auckland (total) ..	**843**	1,016
Canterbury (total) ..	**1,599**	2,515	City	**675**	968
Christchurch ..	**718**	1,440	Other	**168**	48
Other	**881**	1,075	North Auckland ..	**2**	56
Marlborough ..	**148**	179	Taranaki	**198**	320
Nelson	**11**	12			
Total, South Island	**5,628**	6,818	Total, North Island	**5,139**	5,982

Table 3.—Number of Commercial Samples tested of the various Species of Grasses and Clovers, 1934 and 1933.

Species.	Number. 1934.	Number. 1933.	Species.	Number. 1934.	Number. 1933.
Grasses—			Clovers—		
Perennial rye-grass..	**3,510**	4,005	White clover ..	**793**	778
Italian rye-grass ..	**446**	571	Red clover ..	**394**	512
Western Wolths rye-grass	**190**	200	Alsike	**56**	71
Cocksfoot ..	**344**	443	Alsike and white clover	**14**	17
Crested dogstail ..	**891**	907	Subterranean clover	**59**	40
Chewings fescue ..	**887**	985	Strawberry clover ..	**7**	6
Brown-top ..	**478**	380	Crimson clover ..	**9**	20
Danthonia spp. ..	**47**	45	Suckling clover ..	**51**	84
Timothy	**64**	84	Lucerne	**121**	110
Yorkshire fog ..	**37**	70	Trefoil	**13**	28
Meadow fescue ..	**13**	17	*Lotus major* ..	**53**	82
Meadow foxtail ..	**24**	33	*Lotus hispidus* ..	**4**	10
Paspalum ..	**61**	70	Other clovers, &c. ..	**12**	30
Poa pratensis ..	**31**	34		**1,586**	1,788
Poa trivialis ..	**7**	12			
Prairie grass ..	**24**	31			
Red-top	**4**	3			
Miscellaneous grasses ..	**41**	25	Cereals, vegetables, &c.—		
			Oats	**38**	117
	7,099	7,915	Wheat	**53**	71
			Barley	**66**	81
Roots and other forages—			Rye-corn	**3**	2
			Vetches	**10**	1
Swede	**235**	247	Peas (garden and field)	**314**	265
Turnip	**334**	369	Japanese millet ..	**16**	15
Rape	**73**	148	Vegetable-seeds ..	**517**	462
Kale	**139**	105	Flower-seeds ..	**91**	41
Mustard	**15**	23	Forest-tree seeds ..	**16**	7
Mangel	**188**	186	Seed mixtures ..	**61**	10
Carrot (field and garden)	**121**	104	Miscellaneous ..	**2**	36
	1,105	1,182		**1,187**	1,108

Table 4.—Average Percentages of Purity and Germination Capacity for Certified Grass-seed, 1934 (officially drawn Samples).

—	Purity. Average Percentage. Pure Seed.	Other Crop Seed.	Weed-seed.	Inert Matter.	Germination Capacity. Average Percentage.	Percentage of Samples germinating, in Groups. Below 80	80–90.	90–100.	Average Percentage of Pure Germinating Seed.	Number of Samples.
Certified perennial rye-grass—										
All samples ..	**98·8**	0·3	0·5	0·4	**88**	17	12	71	**86**	887
Southland ..	**99·1**	0·2	0·2	0·5	**53**	92	5	3	**52**	61
Otago ..	**98·6**	0·1	0·4	0·9	**88**	16	25	59	**86**	12
Central Otago ..	**98·2**	0·4	0·4	1·0	**95**	8	2	90	**93**	42
North Otago ..	**99·5**	0·1	0·2	0·2	**66**	64	26	10	**65**	19
South Canterbury	**99·1**	0·1	0·3	0·5	**64**	73	15	12	**63**	41
Mid-Canterbury	**98·3**	Trace	0·4	1·3	**83**	36	19	45	**83**	11
North Canterbury	**98·9**	0·1	0·4	0·6	**88**	16	27	57	**87**	69
Nelson and Marlborough	**98·6**	0·1	1·6	1·5	**95**	..	..	100	**92**	3
Wairarapa ..	**96·8**	0·2	0·5	0·7	**92**	..	19	81	**91**	11
Manawatu ..	**99·3**	0·1	0·4	0·2	**88**	18	36	46	**87**	72
Wanganui ..	**98·6**	1·0	0·2	0·2	**83**	40	40	20	**81**	5
Hawke's Bay ..	**98·1**	0·2	1·4	0·3	**94**	5	7	88	**92**	378
Poverty Bay ..	**98·3**	0·6	0·7	0·4	**95**	3	4	93	**93**	164
Auckland ..	..	..	..	..	..	..	..	..	..	..
Certified brown-top	**98·3**	0·1	0·5	1·5	**93**	3	9	88	**91**	124
Certified cocksfoot —										
All samples ..	**70·2**	4·3	0·5	25·0	**88**	6	33	61	**61**	57
Akaroa ..	**70·5**	4·1	0·8	25·6	**89**	4	36	60	**61**	47
Canterbury (Plains)	**71·2**	5·2	0·6	23·0	**89**	10	20	70	**63**	10

Table 5.—Average Percentages of Purity and Germination Capacity for Grass-seed other than Certified Seed.

—	Purity. Average Percentage. Pure Seed.	Other Crop Seed.	Weed-seed.	Inert Matter.	Germination Capacity. Average Percentage.	Percentage of Samples germinating, in Groups. Below 80.	80–90	90–100.	Average Percentage of Pure Germinating Seed.	Number of Samples.
Cocksfoot ..	**70·0**	5·2	1·1	23·7	**85**	15	38	47	**59**	344
Brown-top ..	**95·1**	0·1	0·3	4·5	**85**	10	17	73	**81**	478
*Perennial rye-grass	**98·3**	0·5	0·6	0·6	**85**	18	20	62	**83**	1,780
*Italian rye-grass	**99·2**	0·1	0·4	0·3	**89**	8	27	65	**87**	294
*Western Wolths rye-grass	**98·9**	0·1	0·6	0·4	**88**	16	21	63	**87**	98
Crested dogstail ..	**96·9**	2·2	0·6	0·3	**73**	42	21	37	**71**	891
Chewings fescue ..	**96·2**	0·9	0·7	2·2	**78**	12	22	56	**75**	887
Danthonia spp. ..	**61·9**	4·3	15·7	18·1	**64**	77	23	..	**40**	47
Meadow fescue ..	**97·5**	0·1	1·3	1·1	**63**	54	8	38	**62**	13
Meadow foxtail ..	**61·7**	1·7	1·9	34·7	**59**	83	17	..	**36**	24
Paspalum ..	**58·6**	0·3	0·1	41·0	**81**	24	51	25	**46**	61
Poa pratensis ..	**85·7**	0·1	0·1	14·1	**77**	52	32	16	**65**	31
Prairie-grass ..	**94·6**	0·4	0·7	4·3	**70**	54	17	29	**66**	24
Timothy ..	**99·2**	0·5	0·1	0·2	**91**	2	11	87	**89**	64
Yarrow ..	**92·5**	0·6	2·2	4·7	**87**	16	28	56	**81**	43
Yorkshire fog ..	**88·9**	7·6	2·4	1·1	**88**	14	16	70	**79**	37

* Submitted for purity and germination. For germination only, see Table 6.

Table 6.—Average Germination Percentages for Commercial Samples of Rye-grass tested for Germination only.

—	Average Percentage of Germination.	Percentage of Samples germinating, in Groups.			Number of Samples.
		Below 80.	80–90	90–100.	
Perennial rye-grass—					
All samples ..	**79**	32	32	36	1,730
Southern-grown ..	**79**	36	37	27	1,089
Canterbury-grown ..	**80**	33	25	42	285
Manawatu-grown ..	**77**	44	30	26	117
Hawke's-Bay-grown	**89**	14	11	75	138
Poverty-Bay-grown	**88**	16	7	77	43
Italian rye-grass ..	**85**	14	39	47	152
Western Wolths rye-grass	**83**	27	30	43	92

Table 7.—Average Percentages of Purity and Germination Capacity of Samples of Clover and Related Species.

—	Purity Percentages				Germination Capacity				Percentage of Hard Seed.	Average Percentage of Pure Germinating Seed.	Number of Samples.
	Pure Seed.	Other Crop Seed.	Weed-seed	Inert Matter.	Average Percentage.	Percentage of Samples germinating, in Groups.					
						Below 80.	80–90.	90–100.			
White clover—											
All samples ..	**89·0**	8·4	1·7	0·9	**78**	32	28	40	13	**73**	703
All certified ..	**88·6**	7·3	1·8	2·3	**89**	14	20	66	7	**79**	60
Hawke's Bay ..	**86·0**	8·3	1·7	4·0	**90**	..	15	85	4	**82**	40
Canterbury ..	**95·0**	1·6	2·8	0·6	**84**	33	25	42	14	**85**	12
Other districts ..	**87·1**	11·1	1·2	0·6	**79**	50	38	12	16	**73**	8
Red clover—											
All samples ..	**98·0**	0·6	0·5	0·9	**89**	13	24	63	7	**90**	394
Certified ..	**97·8**	0·7	0·3	1·2	**91**	18	27	55	7	**92**	22
Alsike	**97·8**	1·6	0·2	0·4	**82**	29	23	48	8	**83**	56
Subterranean clover	**97·6**	0·1	0·1	2·2	**77**	31	47	22	15	**80**	59
Strawberry clover ..	**95·6**	2·6	1·1	0·7	**74**	70	30	..	21	**78**	10
Crimson clover ..	**97·7**	0·1	0·3	1·9	**79**	12	13	75	Nil	**77**	9
Suckling clover ..	**80·9**	13·8	4·8	0·5	**46**	93	5	2	35	**45**	51
Lucerne	**98·8**	0·7	0·1	0·4	**85**	21	33	46	6	**88**	121
Trefoil	**95·3**	2·5	0·4	1·8	**88**	8	38	54	7	**86**	13
Lotus major ..	**91·2**	7·5	0·9	0·4	**57**	46	44	10	12	**55**	53

Table 8.—Number and Classification of Rye-grass Samples examined under Ultra-violet Light (Trade Samples only).

Classification.	Number of Samples.		Percentage of Samples.	
	1933.	1934.	1933.	1934.
A1	103	120	31	49
A2	126	54	28	22
A3	41	26	12	10
B1	25	16	8	6
B2	12	9	4	4
B3	19	16	3	6
B4	12	8	4	3

Table 9.—Percentage of Samples containing Seeds of Noxious Weeds and Ergot with Approximate Rate of Occurrence.

Seed.	Percentage of Samples	Number of Seeds per Ounce.	Seed	Percentage of Samples.	Number of Seeds per Ounce.
		Cirsium arvense (Californian thistle).			
Crested dogstail	9	1–56	Chewings fescue	—1	1–2
Cocksfoot	3	3–12	White clover	—1	1–2
Yorkshire fog	3	1–2	*Lotus major*	4	2–14
Italian rye-grass	1	2–15	Alsike	7	1–3
Perennial rye-grass	*—1	1–10			
		Cuscuta spp (clover dodder).			
White clover	1	9–102	*Lotus major*	10	17–120
Red clover	—1	1–2	*Lotus hispidus*	25	1–14
		Senecio Jacobea (ragwort)			
Brown-top	3	2–1,120	Italian rye-grass	—1	1–2
Rye-grass	—1	1–2	Yorkshire fog	3	1–2
Dogstail	—1	1–2	*Lotus major*	8	1–8
		Chrysanthemum leucanthemum (ox-eye daisy).			
Timothy	2	1–2	Yorkshire fog	3	1–6
Poa pratensis	10	1–2	Alsike	2	1–2
		Claviceps purpurea (*Ergot sclerotia*).			
Rye-grass	8	..	Meadow fescue	58	..
Chewings fescue	1	..	Yorkshire fog	30	..
Crested dogstail	6	..	White clover	—1	..
Cocksfoot	8	..	Red clover	4	..
Brown-top	38	..	Alsike	2	..
Poa pratensis	10	..	Suckling clover	2	..
Timothy	2	..	Lucerne	1	..
Italian rye-grass	1	..	*Lotus major*	6	..

*— Indicates less than 0 5 per cent.

Table 10.—Average Germination Capacity of Samples of Cereals, Field Roots, Vegetable, and Flower-seeds.

Cereals, &c.

	Per Cent.		Per Cent.		Per Cent.
Oats	71	Rye-corn	84	Blue lupin	79
Barley	83	Maize	92	Tares and vetches	82
Wheat	94	Japanese millet	90	Flax (*Linum*)	30

Vegetables, &c.

Beans	91	Endive	90	Peas (field and garden)	92
Beet	78	Egg-plant	81	Pumpkin	69
Borecole	86	Kohl Rabi	91	Radish	82
Broccoli	76	Kumi Kumi	99	Sage	73
Brussels sprouts	91	Lettuce	94	Salsify	48
Cabbage	83	Leek	90	Savoy	93
Carrot	69	Marjoram	62	Spinach	73
Cauliflower	75	Marrow	95	Squash	85
Celery	76	Melon	89	Sweet Corn	92
Chicory	66	Onion	76	Tomato	93
Cress	99	Parsley	55		
Cucumber	93	Parsnip	70		

Root and Forage Seeds.

Swede	86	Kale	86	Mangel	94
Turnip	90	Carrot	60	Mustard	95
Rape	94				

Forest-tree Seeds.

	Per Cent.		Per Cent.
Pinus radiata	65	*Cupressus macrocarpa*	14

Flower-seeds.

	Per Cent.		Per Cent.		Per Cent.
Anemone	54	Dimorpotheca	73	Poppy	75
Antirrhinum	62	Gaillardia	53	Ranunculus	32
Arctobis	12	Geum	74	Salvia	39
Aster	70	Hollyhock	83	Stock	82
Auricula	22	Marigold	63	Sweet peas	95
Calendula	91	Mignonette	88	Tagetes	72
Carnation	96	Nemesia	60	Tithonia	58
Celosia	88	Pansy	47	Ursinia	62
Clarkia	72	Petunia	91	Verbena	59
Cosmos	81	Phlox	40	Zinnia	81
Delphenium	74				

—*Seed-testing Station, Palmerston North.*

FARMING IN THE AUCKLAND PROVINCE.

OBSERVATIONS ON FARM-MANAGEMENT METHODS.

P. W. SMALLFIELD, Fields Superintendent, Auckland.

II. SOUTH AUCKLAND AND THE LOWER WAIKATO BASIN.

ON the south and east lie ranges of greywacke hills, which are finally extended as islands in the Hauraki Gulf. The Waikato River breaks through this range at Taupiri, flowing north from the Middle Waikato Basin, and enters the Lower Waikato Basin. This lower basin of the Waikato consists of rolling downs of claystone and loosely consolidated sands and silts, containing much volcanic material and low-lying areas, being the swampy flood-plains of the Waikato and its tributaries. Long sprawling spurs reach out into the flood-plain, from which also low rounded hills rise like islands. Lakes are numerous on both sides of the Waikato River, the largest on the east being Lake Waikare (8,461 acres) and on the west Lake Whangape (2,914 acres). The lakes are all shallow, and their surfaces are but little above the normal river-level: the outlets are across the wide swampy flats of the present flood-plain and the edges of the lakes remote from the river are bordered by gently rolling hills(6). The lower basin of the Waikato is bounded on the north and north-west by a basic-volcanic plateau, which is the chief farming district of the area.

The climate of this area is warm and temperate: the prevailing winds are westerly. The mean annual rainfall varies between 45 in. and 50 in. in different localities. Aspect has much to do with climate, and areas sheltered from the westerly and south-westerly winds are warmer and earlier than areas exposed to those winds.

Dairying, pastoral farming, market-gardening, and fruit-growing are the chief farming industries. Dairying is common on the basic-volcanic land, the undulating clay hills, pumice flats, and drained swamps. Pastoral farming consists in grazing Romney sheep and beef cattle on surface-sown hill country—chiefly greywacke and limestone hills, and fat-lamb raising on the basic-volcanic and undulating clay land. Market-gardening—the production of potatoes, onions, and green

vegetables—is carried out fairly extensively on the areas of basic-volcanic soil. Orchards and vineyards are common on the undulating clay hills in the Lower Waikato Basin at Te Kauwhata. Manukau County had 413 acres and Franklin County 163 acres in market gardens, and there were 850 acres in bearing orchards and 83 acres in grape-vines in Manukau, Franklin, Raglan, and Waikato Counties during the 1933–34 season.

MANUKAU COUNTY.

July 5th, 1935: Mangere, Papakura, Clevedon, Whitford, Manurewa.—A cold dull day with rain threatening. Pastures on the volcanic land showed quite an appreciable growth—subterranean clover and rye-grass throw quite a lot of winter feed in this district, and the common pasture consists of rye-grass, cocksfoot, paspalum, white and

*Table II.—Crops and Live-stock; Table showing the Area in Annual Crops and Pasture and Numbers of Live-stock in South Auckland Counties, 1933-34 Season.**

County.	Crops.			Live-stock.			
	Annual Crops.	Pasture cut for Hay and Ensilage.	Pasture.	Dairy Cows.	Other Cattle.	Sheep shorn.	Pigs.
	Acres.	Acres.	Acres.				
Manukau ..	1,032	9,505	104,633	29,655	17,028	74,164	7,892
Franklin ..	5,224	27,840	191,803	81,199	42,300	60,993	33,072
Raglan ..	4,525	8,797	302,246	34,408	56,758	308,769	11,889
Waikato† ..	5,293	22,716	203,712	73,020	43,856	94,666	27,901
Totals ..	16,074	68,858	802,394	218,282	159,942	538,592	80,744

* From Agricultural and Pastoral statistics. † Part of Waikato County is in Middle Waikato Basin—figures are for whole county.

subterranean clovers. Hay was everywhere being fed out to milking herds, and at Mangere a very well-constructed haystack cover was noticed—an iron roof made to slide up and down six long posts; similar covers are to be seen in Bay of Islands County, but I have not noticed them elsewhere. There must be a tremendous quantity of hay wasted in the Auckland Province through bad curing and insufficient covering: uncovered stacks are often a third or a half wasted by the middle of winter. Most farmers know how good hay should be made and how essential proper covering is in a wet climate, but farmers are faced with difficulties of labour and finance. The making of good hay usually requires much labour for a short time, and, being only able to work between milkings, dairy-farmers are greatly handicapped. Silage is made more satisfactorily than hay, for the work is independent of the weather, and cutting and ensiling can be regulated by the labour available. Possibly the best hay is made working on the lines of ensilage—only cutting each day what subsequently can be handled and carted in a day. If good cocks are built they will turn a lot of rain. Covering of stacks is best done with corrugated iron, and building nearly flat-topped stacks which are fully roofed with iron on completion appears to be a satisfactory method. A few sheets of iron along the ridge do not really cover the stack, and unless the top is well built water strikes in half-way down the roof and often reaches to the centre of the stack.

Passed a field of prairie-grass that was throwing a lot of feed—excellent feed for winter-milk production. One sees only occasional fields like this one where prairie-grass is dominant; the grass requires a light fertile soil—the red basic-volcanic soils are quite suitable—

SOUTH AUCKLAND, LOWER AND MIDDLE WAIKATO BASIN.
Journey in Manukau, Franklin, Raglan, and Northern Waikato Counties.

and the pasture must be dominantly prairie so that grazing and cutting can be carefully regulated. A few scattered plants of prairie in a mixed pasture are soon eaten out. Many farmers have had disappointing results with special fields of prairie-grass, chiefly through sowing

it on land of not sufficiently high fertility. I once saw a 40 acre field of prairie-grass sown on newly broken-in pumice land near Lichfield (Matamata County): the raw pumice soil was very deficient in nitrogen, and accordingly the prairie-grass plants never grew more than an inch or two high, and very soon died.

The western end of Manukau County consists of an alluvial plain on which are dotted basaltic-lava flows and steep-sided scoria cones; on this land dairying for town-milk supply, market-gardening, and fat-lamb raising are the chief farming industries. The farms are comparatively small and gorse-hedges are common—a relic of early settlement. *Cupressus Lawsoniana* and *C. macrocarpa* chiefly are planted now for hedges and shelter-belts. Town-milk suppliers do not as a rule keep very uniform herds—Friesian and Shorthorn cows appear to be favoured along with cross-bred Jerseys, many herds are maintained by buying in cows ready to calve. The production of early fat lambs is a special activity, and there were a number of lambs already about. To the east the country rises in a series of undulating clay hills, merging into the coastal greywacke hill-range, which is broken by an area of flat alluvial land in the valley of the Wairoa River. The coastal hills have been surface-sown, and are used for sheep and cattle grazing; some Corriedale sheep have been established on this country, and the breed is also used on the islands in the Hauraki Gulf. Some people assert that all the coastal greywacke country on the east coast of North Auckland would be suitable for this class of sheep.

FRANKLIN COUNTY.

June 29th, 1934: Papakura to Mercer.—A cold day with heavy westerly rain squalls—bad weather for live-stock, and store pigs and dry sows which were everywhere roaming over the pastures looked cold and miserable. There has been intermittent rain for the past ten days, and there having been no frosts lately, pasture-growth is exceptionally good for this time of year. Dairy-farmers were everywhere busy feeding out hay and many of them swedes to their dairy herds. Judging by the number of herds with their covers on, there is quite a lot of winter milking being done, partly for town supply and partly for ordinary dairying. Many farmers in this district find it convenient to have the majority of their cows calve in May and June, for on the light volcanic land the winter grass growth is quite good, but pastures dry out badly in the summer. Subterranean clover, which is a good winter grower, is common in the pastures, possibly because of the dry summer soil conditions not being entirely suited to white clover.

Passed a field of green oats, which the farmer was cutting and carting out to milking cows. Green oats are excellent for the winter and early spring supplementary feeding of milking cows, but whether they are worth growing depends on many circumstances. Here, in Franklin County, they are sometimes taken as a catch-crop between a main crop of potatoes dug in March and a succeeding root crop. The inclusion of a cash crop in a supplementary feeding-crop rotation enables catch-crops of green oats to be grown very economically. The potatoes leave the ground in a clean and friable condition, and the oats may be drilled in after potatoes with a minimum of surface cultivation. Sown early on light volcanic land, they make a good

growth by early winter, and are particularly valuable for feeding to early cows in June and July. The growing of green oats is often advocated, but is seldom done nowadays, farmers pinning their faith on permanent grass. Occasionally oats are included in a rotation with swedes; grassland is ploughed in February, land worked down and sown in oats in March, the oats used for feeding in June, July, and August, and the land is reploughed in August or September for swedes.

July 6th, 1934: Papakura to Awhitu.—A fine day after rain. The country consists of gently rolling hills of basic-volcanic and loamy clay soils, all in good green pasture. There were many cows in milk, and farmers were everywhere feeding out hay; also large flocks of ewes heavy in lamb and a few lambs, for some flocks here start lambing in June. There were differences observable in pasture-management on farms—here a farm where fields had been shut up and grass-growth saved for early calving cows, there a farm all closely grazed. If grass is to be saved for winter and early spring feeding, supplementary feeding with hay and silage or roots must start in the autumn while the grass is still growing; in short, supplementary feeding must start before it is actually needed.

Visited a small-farm settlement at Awhitu on the south head of the Manukau Harbour. The land is undulating, with a free-working loamy soil, covered by a low growth of manuka and bracken fern; in places the native growth is invaded by a dense growth of hakea. The land had been cleared of manuka and fern, ploughed, summer fallowed, and sown in permanent grass in the autumn (Italian rye-grass, 5 lb.; certified perennial rye-grass, 20 lb.; cocksfoot, 5 lb.; paspalum, 5 lb.; crested dogstail, 3 lb.; red clover, 2 lb.; white clover, 2 lb.; and *Lotus major*, 1 lb.). The land received 10 cwt. of ground carbonate of lime prior to sowing, and the seed was sown with 3 cwt. of superphosphate. Two outstanding things were to be seen in the establishment of the grass—the beneficial effects of a consolidated seed-bed, and of early sowing. Where the land was well consolidated the white clover had struck well, but where consolidation was poor the white-clover establishment was poor. Early March sowings were by far the best: with April sowings the white-clover plants were not sufficiently advanced to withstand the effect of the cold westerly winds direct off the sea.

On the coast there is a narrow belt of sandy country that is used for sheep-grazing, and the pastures consist largely of ratstail. Ratstail on hill country requires heavy stocking with cattle to keep it in the correct stage of growth for sheep. The coarse rank growth is hard and unpalatable, but the young ratstail is quite nutritious, and sheep and cattle thrive on it.

July 11th, 1934: Papakura to Mercer.—A fine day after heavy rain; all streams showed marks of having recently been flooded. Lambs were common all over the district, and farmers were everywhere busy feeding out hay, swedes, and mangels to dairy cows. Mangels are often grown on the dairy-farms on the basic-volcanic areas in rotation with potatoes. The mangel seed is sown in beds in September, and after the "second" early potato crop is dug in November the land is ploughed and the mangels are transplanted. The plants, having bulbs about the size of a man's thumb, are pressed into the edge of the newly turned furrow-slice and then covered by the next furrow-slice as ploughing proceeds. Globe varieties are used, and the rows are made

about 20 in. apart. When transplanted in this way very little inter-cultivation is required. Mangels are also grown after grass. The usual practice then is to skim-plough at the end of winter, plough deeply in November, which gives a thoroughly worked seed-bed, and plough again as the mangels are planted in early December. Care is taken in planting to set the plants at about the same depth as they grew in the nursery beds, and after being covered with the freshly turned furrow-slice the ground is firmed round each plant by the planter's feet. A crop planted in this way in 20 in. rows requires no after-cultivation, and will yield from 40 to 50 tons per acre.

October 23rd, 1934: Pukekohe.—A fine day, and the digging of early potatoes on Pukekohe Hill was in full swing: on ground where crops had already been dug the planting of the second crop was under way. On the frost-free ground on Pukekohe Hill two crops of potatoes are grown each year. The first or early crop, which was being dug, is planted in May or June, and the second crop is planted on the same land immediately the first crop is dug. This second crop is dug in February or March, and is often followed by a catch-crop of mustard for green-manuring. Two crops a year may be taken for three years in succession, but the rotation is often varied by growing crops of onions, cabbages, and other garden crops. The early crops are planted in rows 27 in. apart, with the sets 9 in. to 12 in. distant from one another; planting is done after the plough and sets planted and fertilizer broad-casted by hand. For the second crops, which have stronger tops, the rows are usually widened to 33 in. and sets 12 in. to 15 in. apart. Northern Star (Gamekeeper) is almost the only variety grown: it with-stands late blight fairly well and suits the double-cropping system. Crops are sprayed regularly for late blight: the plants are generally free from virus diseases, which frequently reduce the cropping-power of potatoes in other districts(7).

The volcanic hill country of Pukekohe and Bombay was originally heavily forested, but all traces of this covering are now gone, and in its place are clean grass pastures, generally divided by live hedges of barberry and of *Cupressus Lawsoniana* The pastures round Pukekohe were looking extremely well, and here and there were fields which had been closed for ensilage. Early cutting for ensilage is very desirable; it enables good green silage of high-feeding value to be made. Late-cut silage is often brown or black in colour, and late cutting is also undesirable, as the aftermath on the fields is poor.

WAIKATO COUNTY.

October 24th, 1934: Mercer to Kopuku.—The swamp pastures on the flooded areas of the Lower Waitako Basin show many interesting features. The swampy flood-plains of the Waikato River are covered with water for four or five months of the winter, and many of these winter-flooded areas provide valuable summer grazing. Floating sweet-grass (*Glyceria fluitans*) is found where the winter flood-waters are gently moving: it does not extend far into the swamps, where the flood-waters are stagnant. In the winter it floats on the top of the water, and when the flood-waters have subsided the grass assumes its ordinary form and produces an enormous amount of perhaps the most palatable herbage of our grasses. *Paspalum distichum* also thrives under some-what similar conditions to floating sweet-grass. It grows freely along

the Waikato River and tributaries; it is dormant in the winter, but throws an immense amount of feed in the spring and summer. It throws out long jointed stems which root wherever they touch the earth. The plants have to be propagated by means of cuttings, as the seed does not germinate well. The grass will live for five or six months under water, and when the water starts to go down will grow vigorously. It is an extremely palatable grass and excellent for milk-production and fattening. *Poa aquatica* is a very rank grass which throws a large amount of feed, but is coarse and is not very suitable for dairying, except for dry stock. It will grow for months under water and then "comes away" with great vigour. The leaves look like young raupo leaves and resemble them in general structure, but are much more nourishing. On land that is wet in the winter but not badly flooded are found *Paspalum dilatatum*, meadow foxtail, and *Lotus major*—all very valuable plants. At Rangiriri the flood-waters had subsided, and these marginal swamp summer grazing-areas were making excellent growth. Floating sweet-grass was throwing an enormous amount of feed and *Paspalum distichum* was just breaking into vigorous growth(8).

Leaving these interesting swamp pastures, I travelled on from Rangiriri to Kopuku and examined some recently developed farms on the undulating hills which rise like islands from the swamp. These pastures are now two years old, and pasture-vigour depends on the establishment of white clover. The land is fairly heavy, and was ploughed out of manuka scrub three years ago, worked up and sown in the autumn of 1932. On well-cultivated portions white clover is strongly established, but on dry clay knolls and hillsides white-clover plants are scarce and rye-grass and cocksfoot plants are consequently stunted and poor. Luxuriant white clover is a mixed blessing, and settlers were having a great deal of trouble with cows "blowing" on the vigorous growth of white clover. With the clover the length it is on many of the pastures, the only feasible method of management would be to mow and wilt sections of the grazing-fields each day. When it is mown and wilted the cows relish the feed, and "blowing," if the feed is properly wilted, is overcome. But mowing is not always a satisfactory cure for "blowing," for cows "blow" and die on quite short clover pastures, and in many parts of the Auckland Province white clover causes a considerable mortality in dairy stock. The greatest trouble occurs usually in October, but it may occur at any time if the clover is growing quickly. Hay fed immediately after each milking helps to prevent the trouble.

October 15th, 1934: Mercer to Taupiri.—The undulating hills from Mercer to Rangiriri which rise as a long island from the swamps of the Lower Waikato Basin, are devoted largely to fat-lamb raising. At Te Kauwhata are many orchards and vineyards. The land dries out rather badly in the late summer and autumn, and this makes the pasture land more suited to fat-lamb raising than dairying unless paspalum forms an important part of the pasture sward. From Rangiriri to Huntly stretch flats of recently water-borne pumice, beyond which on the south rise the high greywacke hills which separate the basins of the Lower and Middle Waikato. On the foothills of these ranges pastures are being gradually pushed up into the scrub country—mainly surface-sowings following manuka burns. There were numerous patches of felled manuka which will be burnt and grassed in the autumn.

The type of pasture ultimately secured depends on the amount of top-dressing applied. Under regular top-dressing, rye-grass, white clover, dogstail, with some paspalum and brown-top, make a useful pasture, but without top-dressing reliance has to be placed on danthonia and brown-top.

RAGLAN COUNTY.

July 18th, 1935: Huntly, Rangiriri, Glen Murray, Tuakau.—A fine morning after rain. Pasture-growth is excellent for this time of year, and early lambs are to be seen on the basic-volcanic areas in the Pukekawa – Onewhero district. The road traversed from Huntly to Rangiriri follows the western bank of the Waikato River, and here the soil and pasture conditions are similar to those already described in the adjacent areas of Waikato County—low rolling hills, flat areas of alluvial pumice, and large swamps. Floating sweet-grass (*Glyceria fluitans*) is throwing much feed on the recently flooded areas, while Indian Doab (*Cynodon dactylon*) appears to be a fairly important constituent of the pastures on the pumice flats. its presence being indicated by a white frosted appearance of portions of the pastures. Indian Doab is a poor grass: it throws some feed in the summer, but is dormant in the winter, and on this land, under higher farming, it should be replaced by rye-grass, paspalum, and white clover. Thick blackberry-patches are common in some of the timbered swamps, and on one field there was a herd of thirty or so goats, kept for blackberry browsing. Where the land cannot be ploughed, the establishment of a paspalum sward is the best means of blackberry eradication. The bushes should be burnt (either after spraying or burning with a flame-thrower) and 10 lb of paspalum-seed sown in the ashes in November or early December: sown then the paspalum establishes during the summer and forms a turf ultimately to conquer the blackberry.

Farming in Raglan County consists in grazing Romney sheep and beef cattle on the surface-sown hill country, fat-lamb raising, and dairying on the low undulating hills of the Lower Waikato Basin, the basic-volcanic areas in the north of the county, and the alluvial areas in the river valleys of Raglan Harbour. In the south and west of the county is the western or coastal upland, a deeply dissected plateau, and from it in the south rise Mount Pirongia (3,156 ft.) and Mount Karioi (2,420 ft.). The crest of the Hakarimata Range is 1,234 ft., and in the north the elevated areas decline to 1,000 ft. or less. Originally forested, much of this hill country has been felled and grassed and is devoted to sheep and cattle grazing—the limestone country carries the best pastures. On the drier sandstone hills danthonia is the chief pasture-grass, and there is a good deal of reversion to fern and manuka. In the middle east of the county is the western part of the Lower Waikato Basin already described, and in the north-east corner is the basic-volcanic plateau of Pukekawa-Onewhero, which is the most closely settled and highly farmed portion of the county.

REFERENCES.

(6) Geological Survey Bulletin, No. 28 (New Series) The Geology of the Huntly-Kawhia Subdivision, Pirongia and Hauraki Division.

(7) J. E. BELL: Early-potato Growing in Franklin County. See this *Journal*, April, 1930.

(8) J. E. BELL: Swamp Pastures in Lower Waikato Basin See this *Journal*, September, 1935.

LEMON-CULTURE.

W. K. DALLAS, Citriculturist.

(Concluded.)

PICKING.

Careful handling during picking and carting to the packing-shed is essential to prevent injury to the skin of the lemons. It is necessary for the pickers to wear gloves to prevent scratching of the skin with their finger nails. The lemons should be removed from the laterals with sharp clippers with rounded nose. The stalk should be cut back to a mature bud about an inch and a half from the fruit and then double clipped to remove the stalk and to ensure that it is trimmed level with the button, for unless this precaution is taken the protruding stem-spikes are liable to damage fruits with which they come in contact.

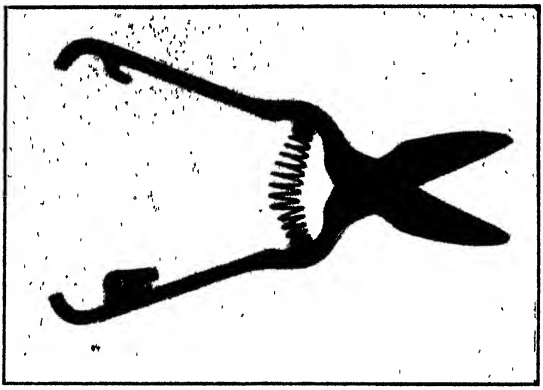

FIG. 4. TYPE OF LEMON-CLIPPER USED IN TAURANGA DISTRICT.

The fruits should not be dropped, but laid in a padded tin or in a picking-bag, which should be so made as to open at the bottom. When sufficiently full the lemons must be carefully transferred to the orchard box, which should not be filled to within more than 1 in. of the top. To roll the fruit roughly into the boxes causes bruising and stem punctures and an ultimate heavy loss, for storage rots usually gain an entrance to the fruit only through injury to the skin.

The orchard boxes should be smooth inside, have no protruding nails, and should be closely boarded on the bottom to prevent the entry of stubble, &c., which may cause injury to the fruit. The boxes should be disinfected prior to each picking in a solution of formalin (40 per cent.), 1 part to 120 parts water.

In orchards where ladder-work is necessary pickers should avoid resting their weight on the picking-bag containing lemons, and, when descending, the fruit should not be allowed to bump against the ladder. Several days should be allowed to elapse after rain before

picking is proceeded with. Fallen fruits should not be placed into the orchard box with the picked fruit, but kept separate. After picking, the fruit should not be left exposed to the sun.

Lemons should be picked when they reach the size desired by the trade, which is approximately 2¼ in. to 2½ in. in diameter. To obtain the finest grade and long keeping they should be picked when they are green or silver-green in colour. Fruit ripened on the tree is usually oversized and coarse, is not amenable to the curing, and is usually disposed of to the factory for the preparation of peel and juice. In order to harvest the lemons in proper condition a picking should be made at least every four weeks, and in some situations once in three weeks is necessary. Growers who do not pick as often as this have in consequence a higher percentage of oversized and yellow lemons than is desired where all the fruit is required for curing.

In loading the wagon care should be taken to see that the fruit has remained below the level of the boxes so that it will not be crushed by the boxes placed on top. The boxes should not be bumped down nor stacked any higher than a person can conveniently reach, which is about six tiers high

Dipping and Sorting.

After delivery at the packing-shed freshly picked lemons should be stored for three days—this tends to reduce the possibility of skin injury during the dipping and sorting operations.

Prior to colouring and curing the dipping of the fruit in various solutions such as borax and bicarbonate of soda for prevention of green and blue mould has been practised for many years, but the treatment used in most instances have given unsatisfactory control. The borax treatment, using 8 lb borax to 10 gallons water heated to 110° F., has given the most promise. The fruit should be held in the solution for four minutes, then drained, dried, and placed in clean sterilized trays, which should be lined with clean paper. This treatment should be done in a room with an atmosphere which is free from mould spores.

The trays used to hold fruit in the curing-room should be well washed and then sterilized with formalin (40 per cent.), 1 part to 120 parts water. The trays should be dried thoroughly, stacked, and covered carefully to prevent contamination while awaiting to be used. Mould infection takes place only through breaks in the skin of the fruit. No dip treatment can take the place of careful handling.

The lemons are sorted according to the following colours: (1) Dark green, (2) silver-green, (3) "coloured," and (4) "tree ripe." The first two grades are the best for long keeping; the "coloured" grade under similar conditions usually does not keep as long as the green grades, and should be marketed earlier. The "tree-ripe" class should be disposed of for peel and juice purposes, &c. The fruits of the respective grades should be kept separate throughout on account of the different keeping qualities and different periods required for curing.

Colouring.

As the majority of lemons are picked green from the tree, colouring is practised to hasten the development of a bright natural lemon colour in the fruits. The colour may be developed by either sweating

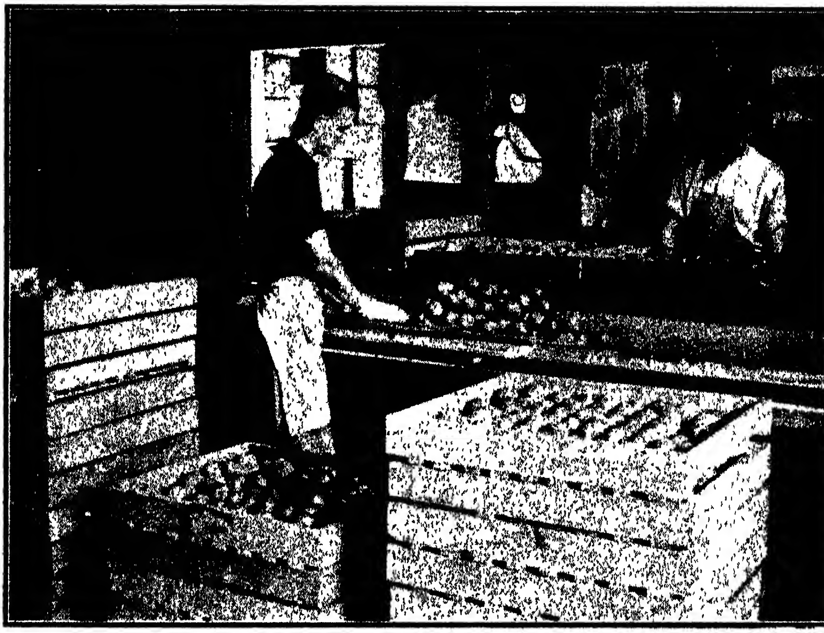

FIG. 5. SORTING LEMONS ON ARRIVAL AT THE SHED INTO DARK-GREEN, SILVER, "COLOURED," AND "TREE-RIPE" GRADES.

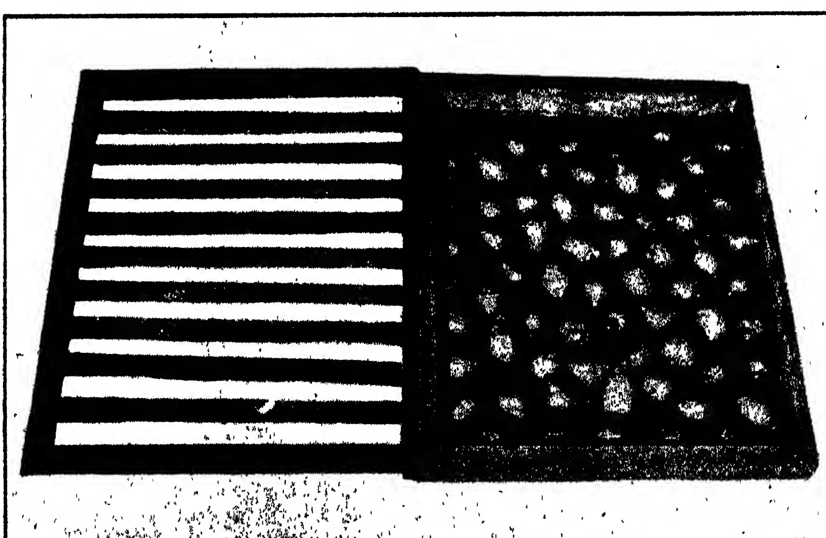

FIG. 6. LEFT: EMPTY TRAY. RIGHT. TRAY FILLED WITH ONE LAYER OF LEMONS.

or by gas treatment. Sweating may be carried out either by storing the fruit in rooms or tents, which should be kept dark or by keeping the fruit covered with thick canvas or other suitable material. The temperature of 70° F. and a relative humidity of 75 per cent. to 80 per cent. should be maintained as nearly as possible for a period which, on the average, is from seven to ten days. Under these conditions the period depends on the degree of colour in the fruit when picked. At a lower temperature the colour will not develop so quickly, while insufficient relative humidity will cause the skin of the fruit to harden and shrivel. To maintain the correct temperature and relative humidity moisture and artificial heat are necessary.

The gas method of colouring lemons is used extensively, either the gas generated from kerosene stoves or ethylene gas being employed. It is stated that the gas treatment somewhat reduces the storage life of the fruit. A room fitted with a door and a window which have been made airtight is suitable for the colouring treatment. The window is necessary for the taking of the temperature and relative-humidity readings. In filling the room the trays, loosely packed with one layer of lemons, should be stacked with 1 in. dunnage between them and with a space between each tier of trays to allow the gas to reach the fruit. A fan or other means of mixing the gas with the air should be installed. The colour continues to develop after the removal of the lemons from the sweating or colouring room.

Paraffin-oil stoves, Perfection B type, or other types fitted with a perforated tin sheet placed on top of the burner to cause incomplete combustion of the kerosene are in use in some countries. A vessel of water is placed on top of at least one of the burners to create the desired humidity. The stoves are placed below the room, and the gas, heat, and moisture pass upwards through a grated floor or in an adjoining compartment from which the gas, heat, and moisture are delivered into the colouring-room by means of a blower. Two stoves are sufficient to colour four hundred cases. In other countries this method is being replaced by the ethylene-gas method, which is cleaner and more satisfactory. Ethylene gas is recommended by the manufacturers for use in airtight rooms at the rate of 1 part of ethylene to 5,000 parts of air. In rooms which leak a higher concentration is necessary. The gas is liberated into the room, from a cylinder with measuring apparatus attached, through an iron or steel pipe. The temperature should be maintained at between 60° and 65° F and the relative humidity about 80 per cent. Two doses per day, one in the morning and the other in the evening, are injected into the room. The lemons under normal conditions are coloured sufficiently in from four to five days. An essential part of the treatment is to ventilate the room thoroughly for an hour before releasing a fresh dose of ethylene so as to replace the oxygen which the fruit has used and to clear out the old gas. It is stated that where ventilating is neglected the buttons readily fall from the fruit. When the colouring process has been completed the lemons should be sorted to remove those of doubtful keeping-quality. The sound fruit should be washed, dried, and placed in single layers in trays for transference to the curing-room.

Washing.

The lemons should be washed and gently brushed to improve the appearance of the fruit by removing all adhering dust and dirt. In

brushing lemons, particularly those which have grown quickly, the greatest care must be exercised if injury to the skin is to be avoided. After washing, if no other means of drying is available, the lemons should be dried quickly in an airy shed, preferably in a position between two open doors where a draught of air may continuously pass over them.

CURING.

Lemon-curing is a term used to indicate a treatment of mild dehydration to which lemons are submitted to improve the quality of the fruit and to extend the period for which it may be kept in sound condition. The treatment causes the skin to become thinner and tougher. The rind of a properly cured lemon should be smooth and soft.

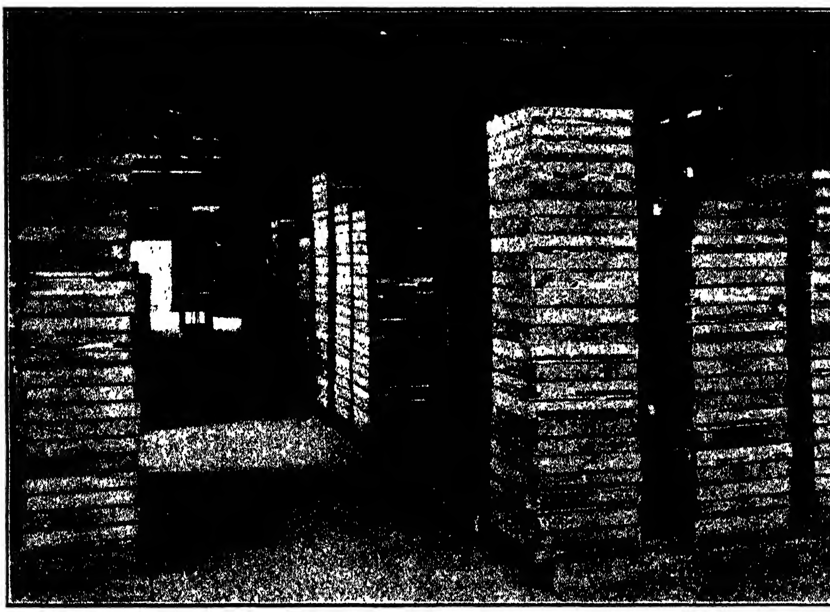

FIG. 7. STACKS OF TRAYS OF LEMONS IN CURING-ROOM (AT TAURANGA).

It is essential during the curing process to maintain a plentiful supply of fresh air. The humidity of the room should not be allowed to fall too low, otherwise the skin of the fruit is apt to shrivel. The relative humidity is determined by means of a hygrodeik, and a reading of 75 per cent. is suitable. An increase in humidity can be effected by sprinkling the floor of the room with water, and some such plan is usually resorted to when the hygrodeik reading falls below 70 per cent.

A cool, even temperature between 40° and 65° F. tends to reduce the liability of green and blue mould-infection in lemons and enables them to be kept longer than those held at other temperatures. If occasion arises, the curing process may be hastened by increasing the temperature, but this should not exceed 75° F. The curing-room should be darkened and draughts avoided.

The stacks of trays should be arranged in blocks with avenues between each block to allow of a free circulation of air. When the trays are being placed on or being removed from the stacks they should be lifted and not pushed or drawn, as this is liable to scrape the fruits on the tray below. The top tray of each stack should be covered with canvas. Cases with one-piece sides or with close-boarded sides are used with satisfactory results by many lemon-growers for curing.

Each colour grade, as determined at the time of sorting of the respective pickings, should be kept in separate blocks, so that the condition of each lot of fruit may be checked regularly to ensure its being marketed when it reaches prime condition. To complete the curing process under normal conditions takes from four to six weeks; very dark-green lemons take from six to ten weeks.

Since mould is usually much more prevalent during the period August–November, the fruit in the curing-room during these months should be examined at least once a fortnight and mould-infected fruits removed. During the remainder of the year examinations should be made at intervals of three weeks. Infected fruit should be handled so as to prevent the spores from being disseminated into the atmosphere of the room. Suitable provision should be made for the disposal of rotten and mould-infected fruits to prevent the spores from entering the atmosphere of the curing and packing shed. Such fruit should be collected in moistened sacks or other suitable receptacles and not placed in open boxes

The fruit should be held under curing-room conditions until ready for grading and packing prior to shipment.

Summary of Recommendations relating to Picking and Curing.

(1) Lemons should be picked green, when they reach the size of 2¼ in. to 2½ in.

(2) The pickers should wear gloves in order to prevent finger-nail injury to the fruit. Picking should be done by means of a specially designed sharp clipper with rounded nose. The stems of the fruit should be cut in such a way as to avoid injury to the "button" and leave no stem-spikes—this in most instances necessitates double clipping.

(3) The fruit should be picked carefully and laid into a suitable picking-bag, and thence placed in the orchard boxes, which should be well made, closely boarded on the bottom, perfectly smooth, and without protruding nails on the inside. Before use the boxes should be cleaned and disinfected with formalin solution (40 per cent.), 1 part to 120 parts of water.

(4) Orchard boxes should be filled to not more than 1 in. of the top, handled carefully, and conveyed to the packing-house in vehicles fitted with springs, the load being in accordance with the strength of the springs.

(5) In the packing-shed the fruit may be dipped in borax solution, dried, and then sorted into the following colours: dark green, silver-green, "coloured," and "tree-ripe."

(6) The fruit may be coloured by sweating or artificially coloured by means of kerosene-stove fumes or ethylene gas.

(7) The lemons should be washed and then dried before being cured.

(8) The "coloured" grade should be packed and disposed of before other grades of cured fruit.

(9) The curing-house should be of such construction as will maintain even termperature and relative humidity, and ventilated adequately in such a manner as to admit conveniently large supplies of air when required.

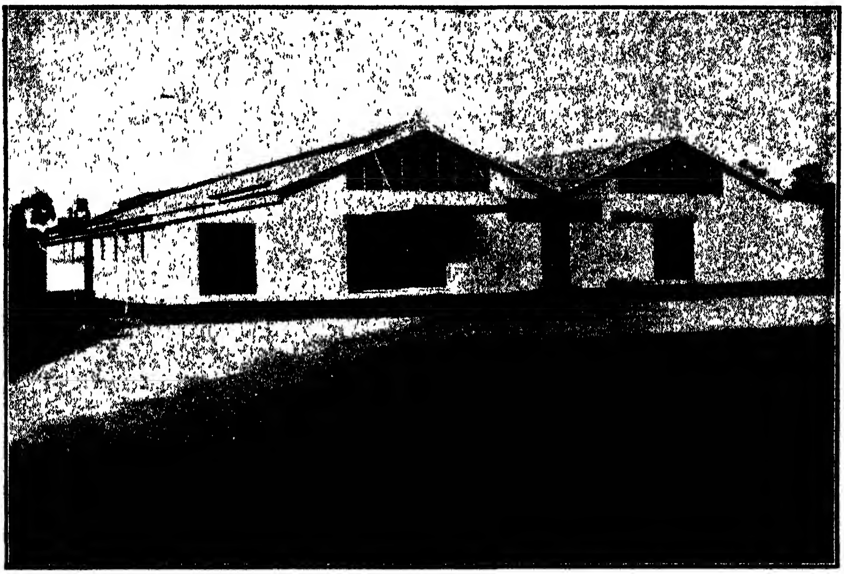

FIG. 8. CURING AND PACKING SHED OF TAURANGA CITRUS ASSOCIATION, LTD., TAURANGA.

(10) Standard grading should be adopted, and particular attention given to eliminating inferior fruits.

Curing and Packing Shed.

The building should be sufficiently large to enable a full crop to be handled conveniently. Packing-houses are usually built to meet individual requirements in respect to receiving fruit from the orchard for washing, colouring, curing, grading, and packing. Considerable thought should be given to the design and lay-out of the building to ensure easy working and a minimum of handling.

The colouring and curing rooms should be constructed 4 ft. above the ground so as to allow of a sufficient height for the stove-rooms built directly below the colouring-rooms, and to allow for ample ventilation beneath the curing-rooms.

Grading.

Grading has become a matter of considerable importance owing to the increased competition due to greater quantities of lemons reaching the markets. Faulty grading is detected quickly by the buyers, and only good, carefully graded and packed fruit realize satisfactory prices. The demand is always keener for consignments which have the reputation of being well graded.

The sizing of the fruit, the grading for quality, and the removal of damaged and blemished lemons usually are done by hand. In grading the greatest care must be exercised, and persons handling the fruit should wear gloves. A considerable amount of skill is required to maintain throughout a grade of even standard and of good quality. To meet the need for uniform grades throughout the Dominion official grade standards for lemons will shortly be gazetted.

Packing.

Growers should bear in mind that their fruit comes in direct competition with that of other growers who have attained a high degree of skill in this work. The pack should be tight and attractive, and to obtain this result the lemons selected for the case should be uniform in size, colour, and quality. There is nothing complicated or difficult about packing, and to become a good packer it is necessary merely to have a knowledge of the fundamental principles, together with practice in the actual operations.

A bulletin dealing with the recognized standard packs for lemons and oranges is about to be prepared.

By-products.

In all citrus areas there is a proportion of the fruit which is below the quality required by the markets, such as over-large, coarse, and tree-ripened lemons. This class of fruit usually can be disposed of for the making of lemon-juice and candied peel. The manufacture of other by-products such as lemon-oil, pectin, citric acid, and citrate of lime, &c., have not yet been developed in the Dominion.

Marketing.

There is no doubt that the handling of the lemon crop is a business which urgently calls for co-operation, as it is by this means only that sufficient fruit is likely to be assembled under one control to allow of uniform curing and grading, marketing in prime condition, and a better distribution. While this is a matter for growers to decide, it is very evident that by individual efforts alone the New Zealand lemon industry will take a long time to reach the position it otherwise might attain readily. In this connection it is satisfactory to note the movement towards co-operation in the North Auckland, Auckland, and Bay of Plenty Districts. The formation of the Tauranga Citrus Growers' Association and the evident determination of the growers of that district to standardize and improve their packing, storing, and marketing methods marked the first definite step in this direction.

HYDATIDS.

FROM A VETERINARY OFFICER'S VIEWPOINT.*

D. A. GILL, Superintendent, Live-stock Division, Wellington.

THE natural course in "hydatids" is from animal to man—never the reverse.

The hydatid of which we speak is the cystic stage in the life-history of a small tapeworm called *Echinococcus granulosus*, which, unlike most of the common tapeworms, is very small—only about ¼ in. long when fully grown, and only the hinder one of its four segments contains eggs. The small size of this parasite has a significance which seems often to be overlooked. Most farmers and other owners of dogs know that dogs are subject to tapeworm infestation, but the conception of a tapeworm is limited to something like a long piece of white tape that is easily seen. Consequently they tend to assume their dogs are not infested because they do not see obvious worms or segments in the droppings. Moreover, a dog-owner who uses worm-medicine because of the possibility that his dog is infested often forgets the small size of *Echinococcus granulosus*, does not see anything in the motions resulting from the medicine that accords with his idea of a tapeworm, and hence considers his dog is free of them, and that he has merely wasted his time in treating it. Even to the trained eye these parasites are not easily seen in fæces unless they are plentiful and unless the hinder segments are "ripe." The ripe segment is fairly conspicuous as it is white and opaque because of the eggs within it, but otherwise the parasite is fairly translucent, and immature forms particularly are difficult to see. This is a very important point when considering control measures.

Dogs infested with this parasite do not, as a general rule, show any symptoms of it. The small intestine is the part affected, but only when a large number of these tapeworms are present does any obvious illness result, and even a thousand or so cause only vague symptoms. There is a slight enteritis and the dog may be irritable, rather listless, show harshness of the coat and diarrhœa. Diagnosis based on symptoms is, therefore, impossible.

Examination of the animal's fæces for tapeworm eggs is quite simple, and the eggs are easily recognizable as being those of "a tapeworm," but one cannot tell the eggs of *Echinococcus granulosus* from those of other tapeworms with any certainty either by their general appearance or by measurements of size. The Casoni skin-test will not detect infested dogs, and, while a complement fixation test may do so, it is too difficult and unwieldy a method for ordinary use.

For how long one of these parasites can live in the host's intestine and continue shedding off ripe segments is not known, but it is probably a long time. Human beings harbouring *Taenia saginata* have been known to continue passing the eggs in their fæces for years without reinfestation.

Perhaps a more important point is how long the eggs of this parasite, *Echinococcus granulosus*, can survive in the outer world while waiting

* Portion of lecture to Sanitary Inspectors' Association, Wellington.

to be picked up by a secondary host. Research on this point has not been extensive, but it has shown that the eggs survive freezing temperature for four months and possibly longer (Dévé, 1908). Sunlight and dessication destroy them fairly quickly. Ross in Australia found that dessication and exposure to sunlight—the temperature often exceeding that of the human body—destroyed the eggs in three weeks or possibly less, while Dévé, in 1908 (quoted by Ross), found that they withstood dessication for sixteen days, or exposure to bright sunlight for two days, and to dessication for a further nine days. Ross found that kept in moist sand they survived three weeks, but not six weeks. These facts accord with the widely held view that hydatid disease is more prevalent in areas with moderately high rainfall and temperature and less prevalent in hot, dry areas.

A question which is often asked and to which a proper answer is important is whether animals other than dogs can harbour this tapeworm—and particularly whether cats may be infested with it. The domestic dog of any breed seems to be the most favourable host, but natural infection does occur in closely related species such as foxes, wolves, and probably dingos, but these species do not concern New Zealand since they do not occur here. As to the possible infestation of cats, actually there are good grounds for thinking that the cat is at most a very rare host for *Echinococcus granulosus*. In the first place, although very large numbers of cats are subjected to post-mortem examination every year, references to natural infestation with the species of tapeworm are very few, and there have been none for many years. It is always possible that the few recorded cases were, in fact, mistakes Secondly, it is extremely difficult to infest cats with *Echinococcus granulosus* even when infected flesh is deliberately fed to them freely. Dévé, in 1904, only succeeded with one cat out of five; Ross, in Australia, in 1926, failed entirely; and Southwell, in England, in 1927, managed to establish infection, but the worms failed to mature or to produce eggs. Briefly, the facts are that cats are seldom, if ever, found naturally infected, that they are very difficult to infest experimentally, that even when that is accomplished the parasite seems unable to mature, and, moreover, from the nature of their diet and habits, cats are much less likely to eat food containing cysts than are dogs. To sum up, in New Zealand the only host of *Echinococcus* that is of any consequence is the dog.

Since it is on infestation of the dog with the adult *Taenia* that all further infestation of man and animals with hydatid cysts is dependent, it is advisable to consider briefly the source from which the dog becomes infected.

Virtually, there is only one such source—ingestion by dogs of raw offal from cattle, sheep, and pig carcasses containing *Echinococcus* cysts. Consequently sheep-dogs and dogs about slaughtering-places are very generally infested, since they are so commonly given to eat the raw viscera of slaughtered animals—and the more abnormal a liver, for instance, looks, the more likely is it to be thrown to the dogs, since it is not considered fit for human food. These things being so, one would imagine that such dogs would be much more commonly infested with *Echinococcus granulosus* than would the ordinary pet dog, and

this is, in fact, the case. Ross in New South Wales demonstrated this important point very well in his work on hydatids. His results speak for themselves and are as follows:—

Class of Dog.	Number examined.	Number infested.	Percentage.
Farm and station	18	7	39·0
Slaughterhouse	36	11	30·5
City of Sydney	100	0	0·0
Rabbiting dogs	20	0	0·0

From this it is clear that the dogs receiving, or having access to, raw offal from sheep, cattle, or pigs are the ones likely to harbour the *Echinococcus*. It also demonstrates the error of the old belief that rabbits are among the intermediary hosts of the parasite. (The cysts found in rabbits are, of course, *Cysticerus pisiformis*, the cystic stage of *Taenia pisiformis* in the dog, a tapeworm that has no significance whatever, for human health, and *Coenurus serialis*, which is the cystic stage of another dog tapeworm, *Multiceps serialis*, also without significance for man.) Investigations in New Zealand have tended to confirm the Australian findings.

It must not be assumed from this that only country dogs are to be reckoned with. Pet dogs are not infrequently fed on raw livers and lungs, and if these come from an ordinary slaughterhouse where no Meat Inspector is stationed, a small cyst may be present, unknown to the slaughterman and quite unsuspected by the dog's owner. Moreover, town dogs are often taken away to stay on farms in the country, and may become infested while they are there on holiday.

The chances of a dog contracting infection by ingesting raw offal depends on the extent to which cattle, sheep, and pigs harbour the cystic stage. The age of the animal is an important factor in this since in all observations that have been made it has transpired that the older the animal the more likely is it to be infested. Probably the most careful survey ever made regarding hydatid incidence in animals was that of Fairley and Penrose in Melbourne, 1928 (*Aust. Med. Journ.*, 24th November, 1928, Vol. II, No. 21). Their figures relating to age incidence may be summarized as follows:—

Sheep under three years, 7·7 per cent.; over three years, 26 per cent.

Cattle under one year, 3·5 per cent.; over three years, 36·2 per cent.

Pigs under one year, 0·4 per cent.; over three years, 5·2 per cent.

Disregarding the age factor the observed incidence in cattle, sheep, and pigs is given by various authorities as follows:—

——	Cattle.	Sheep.	Pigs.
	Per Cent.	Per Cent.	Per Cent.
New South Wales	37·1	35·7	..
Western Australia	19·7	20·1	0·75
Victoria	23·9	16·5	0·5
New Zealand	43·0	46·0	..

These New Zealand figures were collected in August, 1928, and are probably higher than they would be if taken throughout the year, since at that season very little young stock is killed. Other factors from which one might anticipate a somewhat higher incidence in cattle and sheep in this country are that the climatic conditions are more favourable to survival of the eggs outside the body than they are in Australia, and that New Zealand carries much more stock per acre than does Australia.

It will be noted that in the observations quoted cattle show the highest incidence, sheep coming a very close second, and that pigs are much less commonly affected. This last is probably due to the earlier age at which they are killed—usually five to ten months.

In spite of the higher incidence of cysts in cattle, however, their viscera is a far less potent source of infestation in the dog than is that of sheep, because the majority of the cysts found in cattle are sterile or degenerated, whereas in sheep and pigs they are usually active. This is well shown by figures quoted by Monnig in a recent work on Veterinary Parasitology. According to his observations, only 10 per cent. of bovine cysts compared with 80 per cent of porcine ones and 92 per cent. of ovine cysts contain live brood capsules and scolices

In domestic animals these cysts develop almost exclusively in the lungs or liver. Sometimes they may be found in the spleen, the kidney, or in connection with the pleura or peritonium, and much more rarely in some remote part of the body, for example, in bone, or in the heart or brain. But the lungs and liver, as already stated, are the organs affected in the vast majority of cases.

hen the eggs of the parasite are ingested by a suitable host embryos emerge from them into the intestine, migrate into the blood-stream, and are carried by it to the different organs Having come to rest in a suitable spot the embryo develops into a large bladder known as an *Echinococcus* or hydatid. These bladders have an outer cuticle which is fairly thick, and laminated concentrically, and are lined inside with a much more delicate membrane - the germinal layer If all goes normally it is said to be about six months after ingestion of the eggs by the intermediate host that the resulting cysts or hydatids commence to form brood capsules and scolices Within this parent cyst daughter cysts are commonly found, having exactly similar structure to that of the parent, and within them again grand-daughter cysts may occur One sometimes finds in the bovine liver a mass of small cysts separated from each other by fibrous tissue This is often referred to as "*Echinococcus multilocularis*" There is some doubt as to its actual nature, since the cysts are invariably sterile, but it is very generally held to be a manifestation of *Echinococcus* infestation.

In cattle, sheep, and swine the presence of hydatid cysts very seldom causes detectable illness. It depends on the site affected and the number and size of the cysts.

It is very fortunate for the farmer, but is definitely inimical to effective control measures which depend on his co-operation, that the presence of hydatids in the liver and lungs cause so little financial loss. In practically all cases it is only these parts which need to be condemned, and their value is extremely small.

That only an intensive educational campaign will result in this disease being overcome is now widely recognized by all who are interested

in the problem. The Live-stock Division have been endeavouring to improve matters for years by the use of press publicity, by lectures to farmers, and latterly by means of broadcasting. All Meat Inspectors are particularly instructed to prohibit dogs from entering slaughtering-places.

The last feature of this problem on which comment is desirable is the treatment of dogs by arecoline hydrobromide. The efficacy of this for the removal of tapeworms was first stressed by Hall in America, and shortly afterwards by Ross in Australia, who showed how remarkably effective it was in removing *Echinococcus granulosus* from dogs. The dosage is given in the circular and poster that have recently been issued. The proper dosage expels *practically* all the tapeworms present: it is not 100 per cent effective in all cases.

The tapeworms expelled are of no further consequence, but the drug leaves their eggs intact and unharmed, and as each ripe segment contains 500 or so the need for destroying the motions properly is obvious.

While evacuation may commence in a few minutes after dosing, the worms are mainly expelled in the later motions, usually about half an hour after dosing. Dogs should be tied up for some hours therefore, till the effect of the treatment has ceased.

When dogs are experimentally infested with tapeworms by feeding hydatid cysts, it is about the forty-seventh day that eggs are first detected in the fæces—hence the reason for the suggested repetition of dosing at about that time.

Flies alighting on canine fæces containing *Echinococcus* eggs have been found capable of actually ingesting the eggs intact. Hence the possible danger from flies as well as from drying and blowing about as dust if the motions of a dog treated for tapeworm infestation are not adequately collected and destroyed.

FARMERS' FIELD COMPETITIONS, WELLINGTON DISTRICT.

SEASON 1934-35.

W. J. McCulloch, Fields Superintendent, and N. Lamont, Assistant Instructor in Agriculture.

Over a period of years farmers' field competitions have amply justified their importance both to the farmer and the Department as a means of obtaining a mass of valuable first-hand information about specific localities at a minimum of cost to both, and the past season is by no means an exception to the rule.

Looking back over the past history of the movement it has, like various other agricultural projects, had its waves of varying popularity. The early interest in the movement by a district community, often marked by a large volume of entrants, after a time appeared to wane to some extent, but generally this was followed later by a steady increase both in numbers of entries and in general interest.

Improved organization in the management of these competitions as a result of more and wider experience has provided a much better foundation on which to build, and it now seems safe to predict that

farmers' field competitions have arrived at a stage where progress will be steady and lasting. In such work, where the quality of the soil has an important bearing on results, very real difficulty is encountered by the various executives in evolving rules to govern the judging of crops, and while it is agreed that the aim of the movement is to encourage better farming methods, or, in other words, to judge the method of the farmer and not the quality of his land as is sometimes indicated by the heaviest yields, those in control are earnestly advised to continue to seek a solution to this problem. The main difficulty appears to arise from the fact that too many points are allotted for yield and not enough for management during the growing-period. Two organizations who recognize this problem deserve credit for striving to overcome the difficulty by allotting an award for the most meritorious crop.

During the season under review a total of 912 farmers in the Wellington, Taranaki, Hawke's Bay, and Poverty Bay Provincial Districts entered in the competitions. The following table shows the number of entries and the average yields in each competition compared with those of last year.

Competition.	Number of Competitors.		Average Yields, in Tons per Acre.	
	1935.	1934.	1935.	1934.
Mangels	160	105	76·11	63·88
Swedes	97	123	35·78	54·36
Carrots . ..	67	50	46·25	50·06
Chou moellier .. .	14	12	23·27	30·14
Soft turnips	5	6	33·50	48·60
Mixed roots	7	6	37·65	42·50
Ensilage . .	274	330	..	..
Hay	170	197	..	..
Pasture	107	115	..	..
Winter feed .. .	11	..	.	..

It is difficult to draw exact conclusions from a comparison of the average yields of this year and last year, on account of the most unfavourable conditions that were experienced this year. The averages for all crops show a decrease, with the striking exception of mangels, which show an increase of approximately 19 per cent. over last year. The decrease in the case of swedes is approximately 34 per cent. on last year, and in the case of carrots about 7 per cent. The inference is, then, that under competition conditions, when all crops are reasonably well managed, the reliability of swedes in face of unfavourable conditions cannot compare with mangels or carrots.

MANGELS.

The number of mangel entries judged this year was 160, as compared with 105 last year. Results and methods of district prize-winners are given in the accompanying table.

Prizewinner Yellow Globe is still very prominent in the prize-lists. In general, the management of crops by those who won prizes was characterized by thorough cultivation, particularly in the early stages of growth, and the comparative success of mangels under the dry conditions obtaining last season is without doubt due in some measure to this factor, as well as to the inherent drought-resisting properties of this root.

Manurial practices varied a great deal both within and between districts. Mixtures including blood and bone and superphosphate were most popular among the prizewinners, applied in amounts of from 4 cwt. to 10 cwt. per acre, and a large number had been liberal with dressings of farmyard manure. It is interesting to note that a number of winning crops were grown on land that had carried a mangel crop the previous year. Mr. H. T. Paul grew the winning crop in North Taranaki this year on the area which last year produced the record crop. His success is attributed to the persisting effect of farmyard manure applied last year not only by virtue of the valuable plant-foods it contains, but also because of its beneficial effect on the moisture-holding capacity of the soil.

The widths between rows of mangels varied among the winning competitors — from 14 in. to 34 in. — and the opinion has been expressed that many growers are in effect wasting ground by keeping rows too far apart. No doubt the ideal is to have the mangels almost touching on all sides, but in practice the width between rows must depend on whether the crop is to be hand-cultivated or whether horses are to be used. The general rule, then, would be that the width between rows should be the minimum that will permit cultivation by hand or by horses, whichever is more economic under the circumstances. On small areas that are to be hand-cultivated the rows may be no more than 14 in. apart, but where horses are to be used probably 22 in. is the minimum.

It is probable also that yields are reduced through crops being thinned more than is desirable, and there is evidence which tends to indicate that heavier crops can be grown when thinning to about 7 in. to 8 in. is practised than when the thinning is to 9 in. to 10 in.

SWEDES.

The swede-growing competitions attracted 97 entrants, as compared with 123 the previous year. The accompanying table indicates district winners, and summarizes their methods and results.

The Superlative swede was very prominent in the prize-list, being used by ten out of the fourteen prizewinning growers. The most favoured fertilizer was a dressing of about 3 cwt. to the acre in which phosphate predominates. Considerable trouble has been experienced throughout the southern half of the North Island with cruciferous crops, due to their susceptibility to the effects of drought to club-root and dry-rot, and to the attacks of such pests as turnip-fly, diamond-back moth, and the white butterfly. In consequence there is a certain amount of hesitation in attempting the production of swede crops and crucifers in general and a desire to replace them by more reliable crops. It is possible that the apparent greater susceptibility of swedes to drought is due, in part at least, to the less thorough cultivation which is the general lot of swede crops, as a surface layer of loose soil is considered to result in greater retention of moisture by the soil. Furthermore, a plant weakened by drought is less able to resist the attacks of pests and diseases. Despite the above comments, based on the reports of the competitions, it is felt that in favourable districts swedes could be grown with advantage more extensively than has been the case in recent years.

CARROTS.

The number of carrot crops judged this year shows an increase over last year — from 50 to 67 — the majority being grown in Taranaki. The accompanying table contains the principal results.

The success of the Guerande carrot is striking and interesting in that it illustrates that profitable yields can be obtained from this variety, which has the virtue of growing well out of the ground, and, on this account, is easy to harvest or feed off. It is admitted that, to be a success, carrot crops require painstaking cultivation, but it is in dry seasons like last year when the reward for good cultivation is reaped owing to the drought-resistance conferred.

It is reported that the dry weather caused some types of white varieties to bolt to seed, and this tendency is reflected in the lower yields of these varieties and in the lower average yield of all varieties.

Superphosphate and bone manures were most popular, in amounts varying from 3 cwt. to 8 cwt. per acre.

There is a definite place for carrots in cropping programmes where conditions are suitable Yields obtained in the competitions compare more than favourably with yields of swedes, the average of the former exceeding that of the latter by approximately 10 tons per acre. In addition to being a more certain crop, carrots have a slightly greater feed-value than swedes In view of the increased attention to crops grown for pigs it is to be noted the carrot is valuable in pig-feeding.

ENSILAGE.

The number of entries judged in the ensilage competitions showed a decrease as compared with last year—from 330 to 274—one of the principal reasons for this being the fact that many farmers were compelled by unfavourable weather to feed out before their entries could be judged.

In North Taranaki these competitions were very popular and the number of competitors so great that they were divided into classes. The winning competitors in the various classes were—Stack silage (pasture), Mr. A. N. Mills; stack silage (A.O.V.), Mr. H. T. Paul; stack silage (hillside), Mr. F. D. Ballantyne; concrete-pit silage, Mr. E. C. Lacke; earth-pit silage, Mr. J. H. Paulger.

In South Taranaki the winners were—Stack silage, Mr. E. Burnand; pit silage, Mr. C. Jones.

In other districts, where classes were unnecessary, the first prize winners were—Wairarapa, Mr. A. Booth; Hawke's Bay, Mr. F. de Stacpoole; Gisborne, Mr. M. O'Sullivan, Ruatoria Maori Competition, Mr. J. Dewes; Wairoa, Mr. H. S. Findsen.

On the results of the competitions it is not possible to dogmatize with regard to the relative merits of stacks, pits, silos, or trenches, and excellent silage has been made by the different methods. The choice generally depends on the topography of the farm, and although it is probably more difficult to build a stack which results in good silage with little waste than it is to spread the material in a pit, the convenience of the former accounts for its popularity. Where a low, steep bank is available which is conveniently situated and on a well-drained spot, the hillside pit is excellent.

It is inevitable that there should be a certain amount of wastage in stack silage around the sides. A round stack is preferable in this regard to a square one, which will have more waste at the corners. It is necessary that the earth cover be put on immediately after building and brought well out to the edge.

In a number of cases there was considerable waste around the sides of the pits due to the material drawing away from the pit-walls when settling. The practice of winning competitors indicates that this is fairly easily overcome by having the top of the pit a little wider than the bottom.

One of the most common mistakes resulting in low-grade silage was the postponement of cutting until the material was too mature. The recognition of the exact time to cut requires experience and judgment, and very dry weather may cause the material to be less sappy than its appearance indicates. It is probable that silage rarely suffers through the material being too immature. It unfortunately happens that a great number of farmers who are fully aware of the necessity of cutting at the early correct stage are prevented from doing so by labour considerations To some extent, an over-mature material may be prevented from excessive heating by rapid building and immediate covering. One farmer is reported to have used water with some success. A few use salt and molasses with the idea of increasing palatability. Such expedients, however, cannot take the place of cutting at the right stage and must be regarded merely as attempts to save material that might otherwise be inferior.

The competitions have very forcibly demonstrated the fact that, other things being equal, the quality of the silage depends on the quality of the raw material used. Where pasture was used the best silage came from good pastures. The principal function of ensilage probably always will be the conservation of the surplus from pastures. The competitions have clearly demonstrated that excellent silage can be made from lucerne, oats, maize, millet, &c.

HAY.

Competitions for hay were conducted only in the Taranaki District, and attracted 170 entries. The first-prize winners in South Taranaki were—meadow hay, Mr. F. Olliver; lucerne hay, Mr. J. Prout; and in North Taranaki, Mr. R. Cassie.

PASTURE.

A pasture competition was conducted in the North Taranaki district, and 107 farmers participated. Further details of this competition appeared in an article in this *Journal*, September, 1935.

MISCELLANEOUS.

Competitions for chou moellier crops were conducted in South Taranaki and Hawke's Bay. In the former district the competition was won by Mr. F. Jenkins, Eltham, with a yield of 29 tons 1 cwt., and in the latter district first place was gained by Mr. A. W. Montgomerie, Norsewood, with 28 tons 2 cwt.

Table giving District Prizewinners and Summary of their Methods and Results

District.	Grower.	Variety.	Yield.	Seed per Acre.	Manure (kinds).	Amount.	Sowing-date.	Width of Drill.	Remarks.
MANGELS.									
North Taranaki	H. T. Paul(1)	Prizewinner Yellow Globe	149·5	5 lb.	Green bone Potash Superphosphate	4 cwt. 2 cwt. 2 cwt	23rd October	22 in.	Lime previously applied at 15 cwt. per acre
South Taranaki	A. T. Burke(1)	Prizewinner Yellow Globe	153·75	6 lb.	Proprietary	6 cwt	2nd November	14 in.	Well supplied with farm-yard manure.
Manawatu	H. Hancock(1)	Red Intermediate	143·06	5 lb.	Blood and bone	5 cwt.	20th October	22 in.	4 cwt. salt previously applied.
Wairarapa	J. H. Bremner(1)	Prizewinner Yellow Globe	87·1	7 lb.	Superphosphate Blood and bone Sulphate of ammonia	4 cwt 1 cwt. ..	5th October	27 in.	Early January 2½ cwt. am super. per acre.
Hawke's Bay	G. Kells(1)	Prizewinner Yellow Globe	96·35	6 lb.	Special mangel	10 cwt	16th November	20 in.	.
Gisborne	S. D. Briant(1)	Red Chief Intermediate	107·8	5 lb.	Proprietary	.	Mid-October	28 in	No manure.
Wanganui	B. Birch(1)	Prizewinner Yellow Globe	146·85	9 lb	Equal parts bonedust and superphosphate	10 cwt	20th October	25 in	..
Woodville	W. D Beagley(1)	Prizewinner Yellow Globe	93·85	6 lb.	Proprietary	6 cwt.	.	24 in.	3 cwt. kainit previously applied.
Halcombe	E. W Barnett(1)	Prizewinner Yellow Globe	93·6	7 lb.	Superphosphate	2 cwt.	2nd October	28 in.	..
SWEDES.									
North Taranaki	D. Johnston(1)	Superlative	61·85	9 oz.	Superphosphate and slag	5 cwt.	..	7 in.	..
South Taranaki	D. Malone(1)	Grandmaster	51·9	10 oz	Basic slag	2½ cwt.	November	7 in.	Farmyard manure previously applied.
Manawatu	Jacob and Son	Superlative	28·5	1½ lb.	Phosphate and superphosphate	3 cwt.	5th November	..	Only entry.
Wairarapa	W Kjestrup(1)	Superlative	51·85	11 oz.	Proprietary	2½ cwt.	15th December	14 in	..
Hawke's Bay	A. W. Montgomery	Superlative	35·7	12 oz.	Lime and superphosphate	1½ cwt. 3 cwt.	8th January	7 in	..
CARROTS.									
North Taranaki	W. J. Bridgeman	Holmes Improved	63·8	2 lb	Green bone Superphosphate Sulphate of potash	2½ cwt. 1½ cwt 1½ cwt.	8th November	14 in.	Half potash predrilled
Hawke's Bay	G Kells(1)	Guerande	55·6	2 lb	Superphosphate	3 cwt.	26th November	14 in	..
Wanganui	N. Hughes(1)	Guerande	86·6	2½ lb	Superphosphate Carbonate of lime	3½ cwt 10 cwt.	14th November	21 in	.
South Taranaki	A. T. Burke	Matchless White	66·4	2 lb	Proprietary	6 cwt.	2nd November	14 in.	.

A soft-turnip competition was conducted in South Taranaki, and was won by Mr. A. D. Johnson, Lowgarth, with a yield of 40 tons 10 cwt., while Mr. R. Jones, in the same locality, was a close second with 39 tons 4 cwt.

Mr. L. Bishop, Tarurutangi, gained first place in a mixed-crop competition in North Taranaki with a crop of Prizewinner mangels and Superlative swedes.

A very interesting competition was conducted for Maori farmers in Ruatoria and the East Coast with regard to winter feed provision, points being allotted for condition of cows, condition of pastures, and special winter feed provided. The cup was won by Mr. Niha Pei, with Mr. B. Walker and Mr. D. Hughes second equal, and Mr. P. Dewes third.

It has also been the custom in North Taranaki to award a points prize in addition to the separate prizes for each competition. This prize has been won again by Mr. H. T. Paul, Okato, whose entries gained championships in mangels, and A.O.V. silage. Mr. J. H. Paulger, Tikorangi, was second, and Mr. W. F. Goodwin, Okato, third.

CONCLUSION.

Mention must be made of the willing and efficient manner in which the farmers' executives have conducted these competitions and of the various officers of the Department of Agriculture who have acted as judges. This summary of results has been compiled from the reports of officers in various districts

There is no doubt that those who have made these competitions possible have performed a very valuable service for the farming community, especially when the increasing importance of supplementary feed is appreciated. The increasing use of fertilizers for top-dressing pastures has resulted in a general increase in carrying-capacities and consequent difficulty of providing for stock in the winter period. Efficient manurial practices in pasture-management have resulted in an extension at each end of the growing-period, but this by no means offsets the greater demand due to heavy summer stocking on top-dressed pastures. Even if we assume that top-dressing has resulted in an increase in winter growth in the same proportion as the increase in summer growth, the actual amount of the seasonal difference is increased.

In consequence, the provision of supplementary feed has become progressively more necessary, and by field competitions farmers are enabled to discover the practices most appropriate to their circumstances.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 3rd October, 1935, to 28th November, 1935, include the following of agricultural interest :—

No. 73447 : Coulter-clamp ; W. I. Ashby. No. 73481 : Carcass-hoist ; T. D Barker. No. 74435 : Fertilizer-distributor ; P. and D. Duncan, Ltd. No. 74545 : Seed-sower ; P. and D. Duncan, Ltd No. 72423 : Tractor-grip ; D. Bell. No. 72659 : Fibre-dressing ; A. Morrison. No. 72921 : Testing and grading eggs ; P. B. Stevens. No. 73080 : Fibre-dressing , *cognate with* No. 72659 above. No. 73436 : Refrigerating-machine ; W. B. Normelli. No. 73508 and No. 73564 : *cognate with* No. 72659 above.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

OBSERVATIONS ON THE GERMINATION OF NEWLY HARVESTED ALGERIAN OATS.

E. O. C. HYDE, Assistant Seed Analyst

IT is characteristic of the seeds of many plants that they do not germinate readily when newly ripened. During the storage of such seed a process of "after-ripening" goes on whereby the seeds are rendered capable of prompt germination. The oat grain is a seed of this kind. The delayed germination, often observed when oats are sown before the completion of after-ripening, is a matter of concern to the farmer and seed-merchant, and also to the seed analyst.

Most farmers are aware that the sowing of newly harvested oats is attended by the risk of failure on account of irregular germination. For this reason oats which have been held over from a previous season are generally preferred for late summer and early autumn sowings. When newly harvested seed is used it is a common practice to increase the rate of sowing to help to ensure a satisfactory "strike"

Those engaged in the testing of agricultural seeds for germination were early confronted with the problem of obtaining rapid and complete germination of oats during the early weeks after harvesting. Several expedients were resorted to for example, cutting the grains to expose the endosperm, or removing the glumes: Dorph-Petersen(3), Anderson(1). These methods did not gain general approval, and have been abandoned in favour of the practice of conducting germination-tests of newly harvested oats at low temperatures. Atterberg(2) appears to have been the first to observe that oats when not completely after-ripened will germinate promptly at low temperatures. It has since been reported by Eastham(4), Frank(5), and Whitcomb(7) that in testing the germination of newly harvested oats the most satisfactory results are obtained by the use of a temperature of from 5° to 10° C. during the first five days of the testing period, and for the remainder of the time a temperature of from 18° to 20° C.

The practice of testing newly harvested oats at low temperatures has been adopted at the Official Seed-testing Station, and has proved very satisfactory as a means of determining rapidly the proportions of living and dead seeds, and thus indicating what the value of the grain for seeding purposes will be when after-ripening is complete. Such tests, however, do not give any information as to the stage reached in the after-ripening of the seed, and are therefore of limited use when early sowing is contemplated. When it is necessary to use newly harvested seed for early autumn sowing it would be of more value to know what proportion of the seed is capable of germinating promptly in the field at that time. Such knowledge would be of assistance in selecting seed and deciding upon the rate of sowing.

The present work was undertaken to determine whether the technique of germination testing could be adapted to provide a means of gauging the suitability of newly harvested oats for autumn sowing.

Preliminary studies gave support to the presumption that soil temperature is the predominating external factor influencing the germination of oats in the field during the after-ripening period. A

more elaborate study was therefore made of the influence of temperature conditions upon the germination of oats before and after the completion of after-ripening. Field germination tests were made and the results studied in relation to soil temperature and compared with results of laboratory tests.

Material and Methods.

Twenty-five samples of Algerian oats, mostly from crops grown in the Manawatu district, but including also others from Hawke's Bay and Canterbury, were used in the course of this work. The estimates of percentage germination were in all cases based on tests of four hundred seeds. Except where otherwise stated the duration of the laboratory tests was twelve days and of the soil-tests fourteen days. In many of the laboratory germination tests the temperature was alternated daily between two levels, the lower temperature being maintained for about sixteen hours and the higher for about eight hours. In most of these tests the night temperature was 20° C. and the day temperature 30° C. For brevity this temperature provision will be referred to as " 20°–30° C." Field germination tests were made in the open ground in well-cultivated clay loam. Each lot of 100 seeds was sown from 1½ in. to 2 in. deep in a drill 4 ft. long.

Germination of Fully After-ripened Grain.

A composite sample representing several lots of completely after-ripened Algerian oats was tested at various constant and alternating temperatures. In Table I the progress of germination at various constant temperatures is shown. Complete germination resulted at all temperatures used from 5° to 30° C. The greatest speed of germination was shown at 20° C. Of the numerous combinations of temperatures tried in daily alternation as described above the following gave a speed of germination almost equal to that shown at a constant temperature of 20° C.; 20°–40° C., 20°–35° C., 20°–30° C., 20°–25° C., 15°–30° C., 15°–25° C.

Table I.—Progress of Germination of Completely After-ripened Oats at Various Temperatures.

Temperature.	Percentage Germination in Specified Number of Days.									
	2	4	6	8	10	12	14	16	18	20
Degree C.										
5	0	0	0	0	0	0	10	26	65	94
10	0	0	0	11	77	92	98	..	..	..
15	0	43	88	99	..	..	..	..	..	..
20	9	93	99	..	..	..	..	..	..	..
25	0	46	86	98	..	..	..	..	..	..
30	0	10	19	34	54	63	72	85	98	..

Compared with the seeds of most other cultivated plants the oat grain is, when fully after-ripened, capable of germination within a very wide range of temperatures.

Germination of Incompletely After-ripened Grain.

The germination of seventeen samples of incompletely after-ripened oats was studied in a similar manner. Table II illustrates for one of these samples the progress of germination at various temperatures. It was observed that in comparison with the fully after-ripened oats the behaviour of the incompletely after-ripened samples differed in three ways. Firstly, the optimum temperature for rapid germination was lower, being in the vicinity of 14° C. Secondly, the speed of germination at low temperatures was higher than that of fully after-ripened oats under the same conditions. Thirdly, at temperatures of 18° or 20° C. and higher, the germination of a proportion of the grains was greatly delayed. These three features were observed in the behaviour of all the samples of newly harvested oats handled during this work.

Table II.—Progress of Germination at Various Temperatures of Oats not fully after-ripened.

Temperature.	Percentage Germination in Specified Number of Days.										
	5	10	15	20	30	40	50	60	70	80	90
Degree C											
5	0	5	64	99	..	..	..	..	..	..	..
12	32	98	..	..	..	..	..	..	..	..	..
20	12	33	40	48	60	72	85	94	99	..	..
20–30 ..	0	7	12	18	27	38	47	62	74	90	96

When samples of dormant seed were left in the incubator at a temperature of from 18° to 20° C. germination occurred sporadically over a long period, extending in several cases still under observation to over eighteen months. A marked change in the consistency of the endosperm is to be observed in grains of which the germination is much delayed. The endosperm becomes reduced to a fluid "milky" condition. Harrington(6) states that the seedlings from such grains are weakly or otherwise abnormal. Observations made during the present work failed to confirm this.

Frank(5), Eastham(4), Whitcomb(7), and others have shown that newly harvested oats will germinate at higher temperatures after pre-chilling under moist conditions. In the present studies it was found that sixty hours on moist filter paper at a temperature of from 5° to 10° C. rendered most samples of incompletely after-ripened oats capable of complete and rapid germination at 20° C. or at 20°–30° C. The small upper grains were sometimes slower to respond to this pre-chilling treatment.

As already stated, the germination of new oats is greatly delayed at temperatures of 20° C. or higher, but takes place readily at about 10° C. However, it was observed that if new oats which had been placed in a germinator at the higher temperature for six days or more were transferred to a germinator at 10° C. there was little immediate response, and complete germination was delayed in many cases for three months or longer. It thus appears that the

effect of the higher temperatures is not only to inhibit germination during the period of exposure, but also to induce a more intense state of dormancy. This intensification of dormancy by warm, moist conditions was observed consistently in the early stages of after-ripening, but became rapidly less apparent as after-ripening progressed.

It has been reported(8) that secondary dormancy may be induced in new oats by prolonged exposure to low temperatures. This was not confirmed in the present work. Newly harvested oats germinated completely within twenty days at from 2° to 5° C., although the growth of the embryo was very slow.

Comparison between Field and Laboratory Germination.

In January, 1935, eight samples of Algerian oats were obtained shortly after harvesting, and these were tested for germination in the field in the manner already described, and in the laboratory at 12° C. and at 20°–30° C. These tests were repeated at intervals of fourteen days. A fully after-ripened sample was included in each sowing. All tests of this sample showed a rate of germination in excess of 96 per cent. For the incompletely after-ripened samples the maximum rate of emergence of seedlings occurred about the eighth day after sowing. Thereafter the rate of emergence dropped sharply, but additional seedlings continued to appear intermittently over a period of several months, until the observations were discontinued.

The laboratory tests at 12° C. gave complete germination in all cases. In the laboratory at 20°–30° C., and also in the field, the percentage rates of germination were in the earlier tests very low, but became progressively higher as the tests were repeated at fortnightly intervals during the period of after-ripening. In Fig. 1 the results of tests on one of these newly harvested samples are presented. It is seen that the percentage germination in the field was in each case in close agreement with the result of the test made at the same time in the laboratory at 20°–30° C.

Twenty-five comparative tests of germination in the field and in the laboratory at 20°–30° C. were made. The results of these tests are assembled in the correlation diagram (Fig. 2). A high measure of positive correlation is indicated. The incompletely after-ripened grain showed a slightly higher germinating-capacity in the field than in the laboratory at 20°–30° C. When after-ripening was complete the percentage germination in the laboratory generally exceeded slightly that in the field.

In Table III is presented a record of the soil temperature at a depth of 2 in. on the plot. Readings were taken daily at 6 a.m. and 1.30 p.m. It is probable that these readings approximate closely the daily minimum and maximum soil temperatures respectively. The mean soil temperature recordings for each fourteen-day testing-period are lower than the temperature conditions (20°–30° C.) used in the laboratory for the comparative tests. It appears reasonable to attribute to this the fact that the rate of germination of new oats in the field was in almost all cases a little higher than the rate of germination in the laboratory, at 20°–30° C. It may be noted here that there is reason to expect that in drier and darker soils the temperatures during the late summer would be somewhat higher than those recorded during the present work.

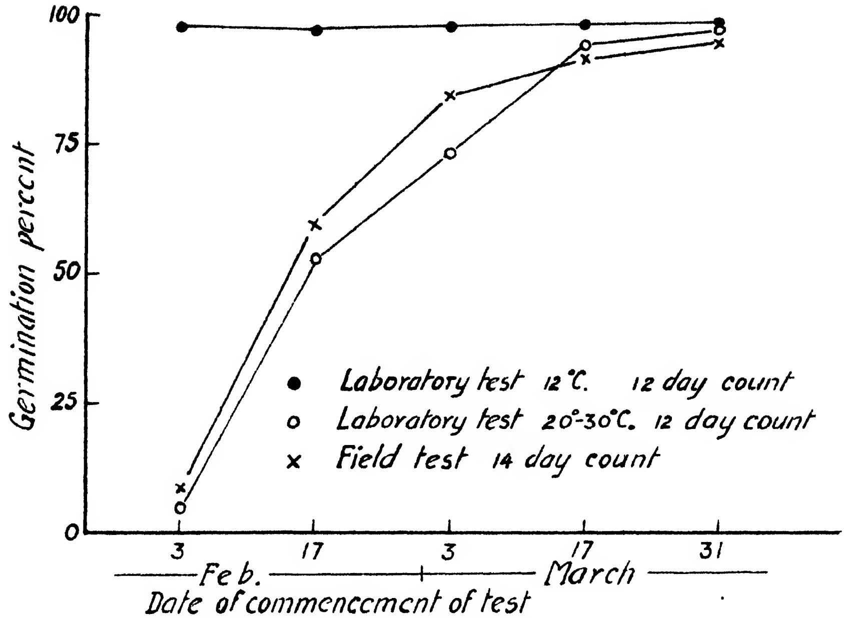

FIG. 1. GERMINATION OF NEWLY HARVESTED OATS UNDER VARIOUS CONDITIONS.
Tests repeated at fortnightly intervals throughout the period of after-ripening.

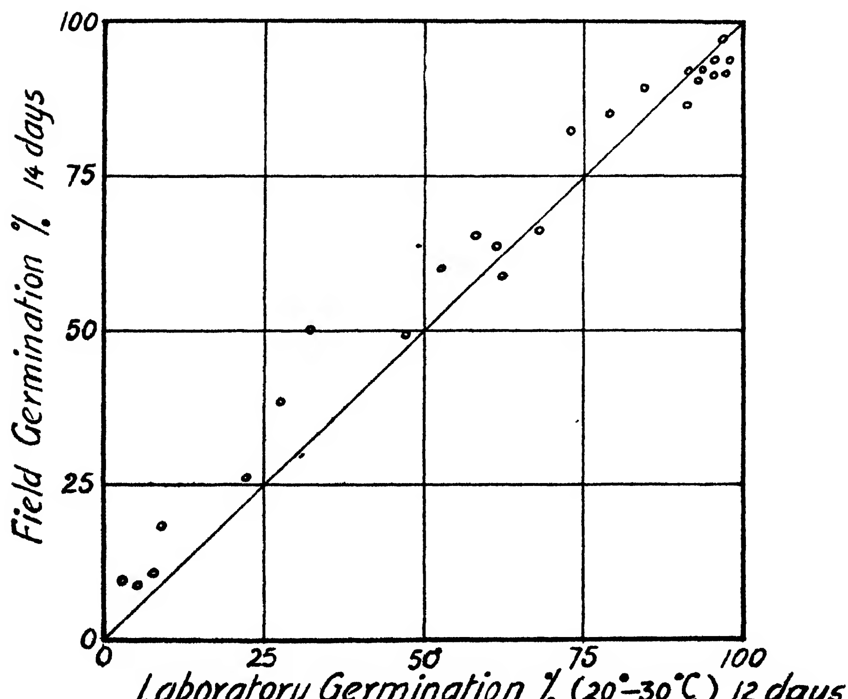

FIG. 2. CORRELATION BETWEEN FIELD GERMINATION AND LABORATORY GERMINATION AT 20°–30° C.

Table III.—Soil Temperature at a Depth of 2 in. on the Field Plot.

Period occupied by Germination Test.	Mean Daily Recording at 6 a.m.	Mean Daily Recording at 1.30 p.m.
	°C.	°C.
February 3 to February 17 ..	19	30
February 17 to March 3 ..	17	27
March 3 to March 17 ..	16	27
March 17 to March 31 ..	15	26
March 31 to April 14 ..	14	25

As regards germination, the behaviour of the grain in the field was similar to that in the laboratory at temperatures comparable to the recorded soil temperatures. The delayed germination of incompletely after-ripened oats in the field may be fairly attributed to the high soil temperatures prevailing during the early months of the year.

It will be observed that in the case of the sample represented in Fig. 1 after-ripening was complete by the end of March. For other samples stored in the laboratory the dates on which this stage was reached ranged from late February to the end of April. From the limited data so far obtained it appears that the rate of after-ripening in the seed-store is slower than that under sample storage conditions in the laboratory.

Conclusion.

The object of this work was to find a means of determining the suitability of lots of newly harvested oats for early sowing. It is considered that the laboratory test with the temperature alternating daily between 20° and 30° C. might be tentatively adopted for this purpose. It is suggested that where newly harvested oats are intended for early sowing such a test should supplement the standard test at a lower temperature. The latter test would indicate the percentage germination which might be expected when the seed is completely after-ripened or is sown when soil temperatures are low. The former test would give an estimate of the percentage of grains which at that time are capable of germinating promptly under summer field conditions. If by this test a low-percentage germination is shown, the sowing may be delayed, or the rate of sowing increased, or other seed utilized.

It should be understood that the progress of after-ripening during the period from the commencement of the test to the time of sowing will render an increased proportion of the grains capable of germinating promptly in the field. To be of greatest use it would therefore be necessary to make the test as shortly as possible before the time of sowing.

Acknowledgments.

The writer wishes to record his appreciation of the assistance given by Mr. O. Galpin, of the Department of Agriculture, Palmerston North.

For the samples of grain used in this work the writer is indebted to the following seed-houses: Messrs. Hodder and Tolley, Ltd., Palmerston North; the Hawke's Bay Farmers' Co-operative Association, Ltd., Waipukurau; New Zealand Loan and Mercantile Agency Co., Ltd., Oamaru; and the National Mortgage and Agency Co. of New Zealand, Ltd., Waimate.

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DRY-DUSTING OF CEREALS.

AN EFFICIENT HOME-CONSTRUCTED PLANT.

T. A. SELLWOOD, Instructor in Agriculture, Oamaru.

THE treatment of the seed prior to sowing the cereal crop for the purpose of preventing smut-diseases has long been carried out, but it is only during comparatively recent years that dry-dusting has taken the place of the wet "pickle." The wet pickles, usually solutions of bluestone or formalin, were quite effective in the prevention of disease, but there were many disadvantages associated with their use. Mr. J. C. Neill, in the *Journal of Agriculture*, July, 1934, fully deals with the disadvantages of the wet "pickle" and with the advantages of the dry-dusting method. He states that one of certain disadvantages of the dry-dusting method is the need for a special machine to do the dusting. This need not, however, be a very costly machine, and some farmers in North Otago have already constructed small plants to carry out this work. One of the most effective is that made by Mr. T. Perry, of Totaratahi, and this plant is proving most satisfactory. It consists of a 40 gallon drum mounted between two uprights at an angle and in such a manner that it can be revolved easily. Towards one end a trap-door is cut in the drum: this end must be the lower end when the drum is mounted. A lid of a heavier material than the drum, and allowing a fair overlap, is made, and this lid has four slots cut in it. These four slots correspond with four bolts welded on to the drum. The bolts are threaded and fitted with large thrumb screws. To ensure that the lid fits tightly to the drum during dusting operations a piece of thick felt slightly bigger than the lid is inserted between the lid and the drum prior to screwing

the lid down. The lining of an old horse-rug makes quite a good pad for this purpose. A shoulder is fitted to each end of the drum in such a position that when the drum is fixed between the uprights it is held at a fairly sharp angle, the axle passing through from the lowest point at one end to the highest point at the opposite end. A suitable axle and handle combined can be obtained by using an old windlass handle. Between the drum and the post on the handle-end a spacer washer is

MR. PERRY'S APPLIANCE FOR DRY-DUSTING SEED.

fitted in order that the rotary motion of the machine will not be interfered with. The spacer washer may be made from 1 in. water-pipe coupling. The uprights must be firm and strong. The cost of the plant in question was—Drum, 5s. ; fittings—lid, handle, &c., £1 10s. ; labour for erection, 10s. : total, £2 5s. The capacity of the drum is two bushels, and seventy to seventy-five revolutions makes a very satisfactory job of the dusting.

The location of the site for the plant is of importance. Ease of access for the handling of large quantities of seed is desirable, while the plant should not be in an enclosed shed as there is a danger of poisoning from the dust if the plant is operated in a confined space. The position of the machine on Mr. Perry's farm is an ideal one—*i.e.*, in the implement-shed, where there is plenty of accommodation for seed and where the ventilation is particularly good.

SEASONAL NOTES.

THE FARM.

Utilization of Special Summer Feed.

OFTEN the best results possible from special feed grown to supplement grassland is not secured because the use of such feed is not commenced early enough. In dairying this arises from the fact that many farmers do not realize how early the need for such feed normally becomes felt. Such special feed should be used not in remedying the position as much as possible after an avoidable drop in dairy production has taken place, but in obviating the occurrence of such a drop. Frequently this means that, if special feed is available, a commencement with the consumption of it should be made shortly after Christmas, for this is when an avoidable drop in production frequently begins, although many seem to deem it unnecessary to do any special feeding until about the beginning of February.

An unnecessarily rapid decline in butterfat-production at midsummer is of particular importance because it generally is correlated with a correspondingly lowered production during the remaining months of the producing-season. Many farmers believe they feed their cows well at the season mentioned, although they do not do so; often they tend to be misled by the ample amount of herbage on the paddocks into believing that the needs of the stock are fully supplied. Really, the stemmy pastures that are of common occurrence and that suggest plenty of feed are faulty for butterfat-production in respect to both their digestibility and their balance of nutritive substances. The only way to supply a fully suitable ration for butterfat-production is to feed leafy non-stemmy herbage which, if not available on the pastures, may be provided by the use of such material as young green lucerne, early quickly-maturing soft turnips, or the fresh aftermath of pastures mowed early for, say, ensilage. The crux of the midsummer dairy feed position is that lack of quality is probably a more frequent cause of unduly rapid decline of yield than is lack of quantity.

Because of the prevalence of stemmy growth in summer, young growing cattle are sometimes forced to subsist largely on it. This is serious mismanagement, because young growing stock, such as calves, develop well only when they receive highly digestible material, relatively rich in the substances required for the formation of bone and of muscle—stemmy growth is deficient in these materials, and its free use may lead to permanent stunting of developing stock.

As far as possible, young lucerne sown in November or December should be left unchecked by mowing as long as practicable, in order to favour the development of an extensive vigorous root-system, which is of value to the crop in subsequent competition with invading plants. However, if such young lucerne has been seriously out-grown by weeds, it probably will be sound practice to mow it towards the end of January.

In carting out soft turnips generally, it is advisable to scatter them well over the field in order that no part of it becomes unduly fouled with droppings, but, if the fertility of a particular area requires building up, feeding of the roots should be concentrated on that area.

Often the earlier-sown rape crops are ready for feeding-off in January. Lambs on rape should have a run-off on pasture, and, when the feeding of rape is being commenced, they should be allowed on it only for a short time.

In order to get the best results from millet, the feeding-off should be commenced when it is from 6 in. to 8 in. high: when it is fed at this stage it subsequently gives a valuable second growth.

Forage Crop Considerations.

Frequently in January it is possible to estimate satisfactorily whether the prospective supply of feed for winter and early spring is adequate, and if it is not there is still time to make additional provision. If favourable weather is experienced in time to allow of the necessary preparatory cultivation, a useful measure in the case of ground which, if not already broken out of grass, would soon be so, is the sowing of temporary pasture in the late summer or early autumn. A temporary mixture generally useful consists of from 25 lb. to 30 lb. Italian rye-grass and 6 lb. of red clover an acre. Temporary pastures must be sown early to ensure that they provide a substantial amount of winter feed, and they generally can be depended upon for a heavy crop of hay in the next season.

When the land available for late summer or autumn sowing will be required in spring for another crop, it may prove well worth while to grow a catch-crop such as oats or barley, both of which usually are sown at the rate of about 2½ bushels an acre. Such cereal catch-crops, under favourable circumstances, yield considerable winter and early-spring feed, and may be followed by root or other suitable crops sown in the following spring. Catch-crops, after turnips or after another cereal crop, at times may be sown satisfactorily with a very small amount of preparatory cultivation: disking may give sufficient tilth for the seed-bed desired.

Frequently the full possible returns from cereal catch-crops or temporary pastures sown in the fall for winter feed are not obtained because the crops are sown too late. This is particularly true of the South Island. With such crops, a dressing of from 1 cwt. to 3 cwt. an acre of superphosphate usually is quite profitable: generally it increases both the rate and the amount of growth.

If sowing of turnips and swedes has not been completed by the end of December, it should as a rule be attended to as quickly as possible. When the rainfall is good sowing may continue to the end of January, but in most localities after mid-January it is safer to grow turnips than swedes, because turnips not only develop more quickly, but also suffer less from the ravages of insect pests which at times become serious after midsummer, especially in dry districts. Imperial Green Globe is a suitable turnip for January sowing. Both turnips and swedes usually respond well to a dressing of from 2 cwt. to 3 cwt. an acre of fertilizer in which superphosphate is prominent, and in which bonedust at times well may be included, especially if the land recently has grown other arable crops. Although generally sowing of lucerne in November or December is preferable, it may at times be sown successfully in January: this applies particularly to districts in which winter growth of plants in general is very small. On the other hand, in mild districts fall sowing of lucerne has often given unsatisfactory results: in such districts the winter cold suffices to make lucerne dormant, but many other plants, including rye-grass and common weeds, make enough growth through the winter to outgrow the young lucerne sufficiently to be able to deprive it of the direct sunlight which is necessary in the spring for its welfare.

General Cropping Work.

Summer tillage of crops which permit of it is of paramount importance. In addition to having the obvious effect of destroying weeds, surface tillage is of marked value as a means of checking loss of soil-moisture. The full significance of this lies in the fact that in many districts, and especially in the drier ones, the most common cause of limited crop-yields is an inadequate supply of soil-moisture. Further, cultivation brings about soil-aeration which leads to improved fertility. Attention to summer cultivation usually

proves particularly profitable to the farmer who grows such crops as potatoes, mangels, swedes, and carrots in rows wide enough apart to allow of inter-tillage.

Potatoes, apart from needing inter-tillage and weeding at this season, usually should be moulded up. In districts in which the crop is likely to be subject to the attacks of the potato-moth moulding-up should be carried out with especial thoroughness, as well-covered tubers are likely to escape infestation by the moths.

It is very desirable to cut cereals at a suitable stage of ripeness. Investigation has shown that the best stage at which to cut wheat is when the green colour has been replaced by yellow in the section of the stem between the top " knot " and the head of about 99 per cent. of the stalks or straws. At this stage all " knots " are still green, and no dough can be squeezed from the grain, which, however, is still soft enough to be cut by the thumb-nail. Generally oats should be cut just when they attain a uniform yellowish appearance and before the final touch of green has disappeared. Quite often oats for chaff are cut when too ripe ; for chaff they well can be cut slightly earlier than the stage just described. Barley for malting should not be cut until it is dead ripe, as, if cut earlier, the germination of the grain is likely to be uneven, and this lowers its value for malting purposes.

As a rule thinning of such crops as mangels and carrots calls for attention at this season : undue delay in respect to this task may result in permanent stunting of the plants If the seedlings are pale and seem not to be thriving sufficiently, a dressing of 1 cwt. an acre of nitrate of soda scattered along the rows close to the plants and hoed in after thinning may prove well worth while.

The Pastures.

The task of pasture-establishment is a critically important one : the harmful effect of any weakness which arises in a permanent pasture at its establishment is likely either to be perpetuated throughout its life or to be removed only after considerable cost in respect to repair or replacement Now that great permanence of good pastures usually can be assured by the use of suitable strains of seeds in conjunction with judicious top-dressing, it is particularly advisable to prevent any avoidable weakness developing in the sward at the outset.

Frequently the principal cause of poor-pasture establishment is the sowing of seed on poorly tilled ground—ground loose and lumpy, rather than fine and firm ; at other times the principal cause is late sowing of the seed. Usually both of these causes may be traced to the starting of preparatory cultivation at too late a date. This cultivation of land which is to be sown in permanent pasture in the autumn should now be kept in view. Intensive tillage for a short period may be employed to produce a fairly well pulverized seed-bed, but it is advisable to note that such tillage obviates the natural weathering which experience has shown to be of great value in producing economically the firmness and fineness of seed-bed that favour fully successful pasture-establishment.

If a seed-bed is not fine, the covering of the seed at greatly varying depths takes place, and hence if some of the seeds are sown at a suitable depth many others must be sown at unsuitable depths ; in pasture seeds which are relatively minute the risk is that a substantial proportion will be buried so deeply as to make it impossible for seedlings to be established from them.

Because lateness of sowing seldom tends to a complete failure, there seems to be an unfortunate tendency to overlook the harm that results from it ; while this harm does not get the attention that a complete failure would, it at times certainly is great enough to warrant steps to avoid it : it often consists of a thinning-out of the clovers and at other times of such slow weak development of most species in the mixture that weeds are given a greater chance of becoming prominent.

Sometimes there are serious weaknesses in the mixtures used for permanent pastures—weaknesses which cannot always be avoided when seed is purchased

in a hurried haphazard way which does not allow time for obtaining as much information as is desirable about the strain-characteristics and the germination capacity of the lines of seed offering. It clearly is unwise to leave the purchase of pasture seed mixtures to the last day or so before sowing. It is particularly desirable to be careful about seed which is offered at an attractively low price—such seed may constitute a bargain, but as a rule it is markedly dear because of its poor type or poor germination capacity. No farmer is likely to attain full efficiency and ignore in his purchase of seeds the present knowledge of different strain-characters within the one species. Full information regarding strains of pasture species and about pasture seed mixtures generally may be obtained from local officers of the Fields Division.

Pastures from which hay or silage has been saved may be expected to react profitably to a dressing of superphosphate applied as soon as the mown material has been removed. Such top-dressing tends to produce a greater immediate aftermath of fresh leafy feed which is especially valuable because it becomes available when such feed frequently is needed urgently—between the midsummer going-off of the pastures and the becoming available of such crops as soft turnips. Pastures mown at a somewhat immature, that is non-stemmy, stage generally have more vigorous and abundant aftermaths than similar ones mown at a later stage. Hence the former give the greatest immediate return from such top-dressing, but pastures mown at an over-mature stage frequently are weakened and so are in particular need of the benefit provided by judicious top-dressing.

Generally it is desirable to avoid seed-production or the development of stemmy rank growth of young, permanent pasture during its first summer. Such development may lead to the weakening of certain species, which, though relatively slow in growth in their early stages, are especially valuable in permanent pastures. When young pastures cannot be controlled suitably by the stock available, topping with a mower usually should be practised. Some pastures are used for seed-production during their first year, but these are special cases involving special returns from the seed-crop, and so are not a reliable guide as to economic general practice.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Pest and Disease Control.

By the end of this month the last sprays prior to harvesting should have been applied to all early and semi-early varieties of peaches, and to the earlier varieties of apples. During the coming month of January, to the earlier of the export varieties such as Cox's Orange and Dunn's Favourite, a further application as outlined in the November notes, the last before harvesting, should be applied.

Where red mite is in evidence, a further effort should be made to eradicate it before the laying of the over-wintering eggs takes place.

The spraying recommendations given previously should be followed during the coming month, spraying being continued on each variety up to within three weeks of picking.

Cultivation and Cover Crops.

Where a cover crop such as blue lupin is to be grown for ploughing under in the autumn, the soil should be put in excellent tilth, and the seed sown during the early part of January.

The soil should not be allowed to harden and crack. To prevent this where cover crops are not being sown, the cultivation should continue during January. Should dry weather set in, it is very necessary that the soil should be regularly stirred to maintain a good tilth.

Thinning.

It is reported that very heavy crops of apples have set generally, and that a large crop is assured for the Dominion. This being so, there is every possibility of a larger quantity of apples than usual being available for disposal on the local markets. With the larger local surplus to dispose of, every effort should be made to prevent flooding the markets with second-grade fruit, and as far as possible this fruit should be eliminated by thinning. Where the trees are heavily laden, an endeavour should be made to remove all but fruit likely to develop into first-grade fruit. This not only assists the tree and the growing crop, but obviates the markets becoming over-supplied with low-grade fruit. Growers are strongly advised not to neglect the thinning of their crop.

Fireblight.

As advised in recent monthly notes, a strict watch should be kept for any signs of fireblight infection, and all infected material should be promptly gathered and destroyed as soon as it is noticed.

General.

The coming few weeks mark the commencement of the harvesting-season for many growers, and very shortly every one becomes busily engaged in picking, packing, and despatching the fruit to the markets.

No time should now be lost by those who have not yet done so in getting everything in readiness for the rush and bustle of the season, so that the season's work may commence without confusion Where necessary, arrangements for labour should be made early to avoid disappointment.

As far as possible, fruit intended for the local markets should have reached a degree of ripeness which ensures the proper completion of the ripening process. Sound, full-flavoured fruit commends itself to the consumer, and, as a result of its quality, increases the demand. There is no doubt that the marketing of immature fruit, especially the export "reject," does incalculable harm. It must be remembered that the demand for fruit is made by the consumer, and that to increase the demand his desires for ripe, full-flavoured fruit must be met.

—*R. G. Hamilton, Orchard Instructor, Hamilton.*

Citrus Notes.

Every effort during the coming months should be made to conserve the soil-moisture as much as possible. In the event of a dry spell being experienced, especially at the present time, the trees, where the land is insufficiently cultivated, are likely to suffer through want of moisture. Owing to the fact that many of the trees are still carrying a heavy crop of fruit any shortage of moisture is likely to have a detrimental effect on the setting of the next crop. On account of the low prices that have been ruling for lemons, growers have allowed much of the fruit which should have been harvested to remain upon the trees. The trees would benefit from an application of nitrogen in the form of sulphate of ammonia, applied at the rate of from 2 lb. to 4 lb. per tree, according to age and size, and this if worked into the soil would become almost immediately available.

Young trees are now showing a considerable amount of new growth; they should be carefully examined, and where an excess of growth has taken place some judicious pinching should be carried out. Any strong perpendicular shoots not required for the frame-work of the tree should be shortened back to induce side growth, while those shoots wanted to develop the framework may be lightly tipped to ensure stability.

Young borers are now active, and should be destroyed following the removal of the infected twig, which may be detected by the wilting of the

leaves. On larger limbs the castings show where borers are established. In this instance to kill the borers a few drops of benzine may be injected into the burrows, which should then be plugged with putty or soap.

Where necessary, a further spraying of Bordeaux mixture should be applied for the control of verrucosis and scab, and where thrips and scales are present it is advisable to apply nicotine sulphate and summer oil as advised in the November Notes.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Care of Growing Stock.

By this time all young stock should have passed the brooder stage, incubators should have been cleaned and disinfected, and brooders cleaned and put away for another season.

It is essential to keep the young birds growing, and every effort should be made to prevent any check in their development, the chief causes of which are over-crowding, insanitary quarters, and stale ground. Before moving young stock to fresh coops or houses, care should be taken to see that such quarters are thoroughly cleaned and disinfected. To do this work properly, first remove all perches, nest-boxes, and litter, in fact, everything movable, from the house, and if the floor is of earth, about 3 in. of the soil should be removed. The ceiling and walls should be swept down with a stiff broom, and then be thoroughly washed with a spray pump or garden hose, or with a scrubbing-brush, using plenty of water so that all dirt is removed from cracks and corners. Any accumulated dirt should be swept out.

Finally, it is advisable to give the walls, ceiling, and floor a good spraying with a strong solution of some good disinfectant, and if possible to leave the house for a day or two to dry. If perches are painted every ten days or so during the warm weather with waste car-oil or a mixture of two parts of waste car-oil and one of kerosene, there will not be much danger of insects infesting the young growing birds.

As the birds grow they require more perch-room, and it pays poultry-keepers to visit the roosting quarters regularly after the birds have gone to roost to make sure that they are not overcrowded. Overcrowding not only checks the desired development, but it is one, if not the chief cause, of autumn colds amongst growing stock. Adult birds require at least from 8 in. to 9 in. perch-room each.

The first sign of a cold is usually observed when dust collects round the nostrils, then, later on, comes sneezing with a watery discharge from the nostrils and eyes. Everything possible should be done to prevent even a slight cold from making its appearance, and if the roosting-quarters are visited regularly and care taken to see that plenty of perching-accommodation and ample ventilation are allowed, much will be done to prevent an outbreak of colds, which may turn to roup if neglected.

The grading of the growing birds regularly, and the culling-out of any weaklings (even pullets), will also go a long way towards assisting in the proper development of young stock. Feed for growing birds should be plain but of good quality, and the aim should be to build frame and bone but to avoid those substances that are likely to encourage prematurity.

A good growing mash may be made up of from 2 to 3 measures of pollard, according to quality, to one measure of bran, 3 per cent. of bone-flour, and one measure of finely cut succulent greenstuff, and the lot mixed with skim-milk. If no milk is available, about 5 per cent. of meat-meal may be added. A grain mixture of equal parts of wheat, barley, and a good short oat, should give good results. If growing stock are fed too much animal-food they usually come to maturity and start laying before they

are properly developed, with the result that small eggs are produced. Such pullets seldom lay for a very lengthy period, and never make desirable breeding-birds.

At times some poultry-keepers are inclined to more or less starve their pullets if they notice that they are coming on too quickly, but this policy does not lead to the best results, and it is far better to give the growing stock plenty of good plain food, and if they appear to be coming to maturity too quickly to reduce the amount of milk or meat-meal.

Care of Late Chickens.

On many farms where the natural means of incubation have to be relied upon, it is not always possible to get chickens as early as desired. Where late chickens are being raised, it is well to make sure that they are reared on fresh clean ground and that the birds can get shelter from the hot sun. If no natural shelter is at hand, some artificial shelter should be erected by means of branches or sacks.

Care of the Laying-hens.

A flock of good hens should give a 64-per-cent. production during December, and about 56 per cent. during January, or in other words 100 hens should lay on an average sixty-four eggs per day during December and fifty-six eggs per day during January.

The aim of all poultry-keepers should be to keep the hens laying till the pullets commence to lay. On some farms at the present time a few birds may be noticed to be drying up in the comb and even going into a moult. This is not unusual, but such birds should be culled, for they are usually weak specimens However, when a large number stop laying and go into a moult during December or January, it is generally an indication that the stock are not getting sufficient feed. It is well to keep a close watch on the egg-yield, and if the number is not being produced look for the cause. Very often a little extra feed from now on, and a little extra skim-milk or animal-food will keep the hens laying well into the autumn. Where hens have been laying well for many months, special care should now be taken to see that they are given all the mash and grain that they require.

Chick-sexing Examination.

The first New Zealand chick-sexing examination was conducted at the Wallaceville Poultry Station by the Department of Agriculture on 4th November.

Fifteen students undertook the examination, but only three were successful in qualifying for a second-class certificate. These were Mr. D. E. Hopkins, Otaki, who sexed 100 White Leghorn chickens in 18½ minutes, with an accuracy of 90 per cent.; Mr. W. H. Barnes, 7 Elizabeth Street, Wellington, who sexed 100 chickens in 20 minutes, with an accuracy of 90 per cent.; and Mr. H. C. Morton, 436 Esplanade, Island Bay, Wellington, who sexed 100 chickens in 18½ minutes, with an accuracy of 90 per cent. These students are to be congratulated and all will wish them success in the work they are undertaking.

The Department was prepared to issue certificates to those qualifying as under :—

(A) *First-class Certificate :* Those sexing 200 White Leghorn chickens in 30 minutes, with an accuracy of 95 per cent., without killing a chicken or causing injury.

(B) *Second-class Certificate :* Those sexing 100 White Leghorn chickens in 20 minutes, with an accuracy of 90 per cent. In the event of more than one chicken being killed, or more than three injured, the student will be disqualified.

Export of Eggs.

The egg-export season for 1935 has now closed. A total of 11,915 cases of 30 dozen each was shipped from New Zealand to London.

The quantities from the respective centres were as follows: Auckland, 2,610 cases; Wellington, 191 cases; Canterbury, 6,366 cases; and Otago 2,748 cases. This shows an increase of 323 cases, or 9,690 dozen, over the number shipped during the 1934 season.

The Canterbury total of 6,366 cases, or 190,980 dozen, is not only a record for the province, but the largest number sent from any centre during any one season.

It is pleasing to note that the shipments are arriving in London in perfect condition.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Returning Swarms to Parent Colonies.

SWARMS in January are of little value except as increase for next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the colony is cramped an extra super may be given, and with this inducement the colony usually settles down at once to work.

After-swarms always should be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin queens can be picked out easily as they attempt to force their way through, and once these are removed the bees return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frame, when she will be accepted by the bees.

Ventilation.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air by day and night. All weeds and other obstructions should be removed from the front of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colony.

Handling of Supers.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen allows his bees to loaf or cluster outside the hives for lack of storage room. It is well, when adding additional supers, to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should be understood, however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work on the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not yet hatched—it is an excellent plan to tier up with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

Use of Queen-excluders.

January is the month when queen-excluders are of most use to the bee-keeper, especially in South Island districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees sometimes attempt to raise queen-cells above the excluder. If this happens, the queen-cells should be destroyed, as the queens which emerge from them are not able to pass through the excluders to get mated, and in time develop into drone-layers. By providing the queen with plenty of empty combs she becomes able to continue laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells at once become filled with honey.

Queen-excluders are often condemned as being productive of over-swarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers is carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

THE uncommonly wet spring has been a severe test for many seedling crops. Where they have been sown thinly in clean land they generally have made good progress and all is well; but thick sowings, in weedy ground, after a few weeks of showery weather which prevented much work being done outside, now present a long expensive task which will increase the costs of production very considerably. The preparation of the land, especially for spring-sown crops, should include a period allowing for any weed-seeds near the surface sprouting and being destroyed by light cultivation before sowing down with crop-seeds of a known vitality, so that the sowing rates may be nicely adjusted. If quick advantage is then taken of dry intervals the work is comparatively light, even when such intervals are rare. The experience of the last few months has again shown us that good preparation is one of the big factors in successful cropping.

Among the crops maturing during the month of January are shallots, garlic, and autumn-sown onions. To obtain a bright sound sample dry weather is required while they are curing; if wet weather intervenes the process should be concluded in a good open shed.

During January the planting of winter crops of savoy, red cabbage, brussels sprouts, kale, broccoli, cauliflower, leeks, and celery should be completed, observing the methods and precautions mentioned in last month's notes.

Late crops which may be sown include peas, dwarf beans, short-horn carrots, globe beet, turnips, radish, parsley, winter spinach, silver beet, lettuce, and endive. These valuable crops for autumn and winter use should receive close attention. Much interest has been taken in mushroom-culture, especially the production of out-of-season crops in chambers where the conditions are under control. The local markets may not warrant extensive cropping of that kind, but at the present time mushroom spawn may be planted outside for producing a crop under natural conditions in localities where a sufficient supply of "wild" mushrooms are not usually found. The natural temperatures and humidity of the autumn months are generally suited to the crop. The bricks of spawn are broken into six or eight pieces about the size of a hen's egg and planted 1½ in. deep in fermented stable manure. They may be planted 9 in. or 10 in. apart in a disused hotbed, and the bed afterwards covered with 1 in. or 2 in. of light fresh soil passed through a riddle, and beaten down; or planting may be done in a well-drained paddock by removing a turf 1 ft. square; then 4 in. or 5 in. of soil, which is replaced by fermented stable manure, with one piece of spawn in the centre, firmly trodden down and the turf replaced and beaten down as firm as possible.

Considerable anxiety was caused in some localities by the dry weather last season, and it is necessary to be ready for such experiences. Vegetable crops, such as salads, especially celery, marrows, cucumbers, peas, and beans, deteriorate rapidly under dry conditions unless assistance is given. A very light mulch of lawn-mowings, or fermented stable manure, passed through a sieve, may be broadcasted on the surface of the ground after its preparation is completed and before planting the crop—or after sowing it. It will greatly improve the conservation of moisture and check the tendency of birds to dust themselves in a fine seed bed. Longer straw may be used between the rows of widely spaced growing crops. This mulch of humus goes a long way in conserving any moisture that may be available and preventing the serious damage done to crops by sudden changes in the amount of the water-supply.

In a dry season the late-potato crop should be moulded-up well to prevent the attack of potato-moth, *Phthorimaea operculella*, reaching tubers which may be otherwise near the surface On the other hand, in humid districts, or seasons, late blight is now a danger to this crop, and two or three applications of Bordeaux or Burgundy spray at intervals of two weeks to a month, according to weather conditions, should be made.

The tomato crop under glass in unheated houses will now be at the peak of the harvest, and attention to watering, ventilation, and feeding with liquid fertilizers will be the chief requirements. Except in stormy weather generous ventilation will usually be required, especially in the early morning. The crop outside will commence to ripen towards the end of the month of January; and, to protect it from the attack of diseases and pests, pruning and tying must be given prompt attention so that spraying may be done effectively. The larvæ of the stem-moth, *Gnorimoschema plaesiosema* which tunnel the base of the vine, and thrips carrying virus infection are the most likely pests in fine weather.

Small Fruits.

A surprising number of different kinds of fruits come under this heading—Raspberries, gooseberries, and currants; strawberries, Cape gooseberries, and the so-called cranberry (*Myrtus ugni*); Chinese gooseberry (*Actinidia chinensis*); loganberry and passion-fruit; tree tomatoes, guava, and *Feijoa sellowiana*; loquats (*Eriobotrya japonica*) and mulberries; with perhaps olives and figs. The three first-mentioned require to be grown in districts that have a climate which is distinctly cool; the remainder thrive best in the warmer localities, except the strawberries, which are perhaps the least particular so long as other conditions are suitable. The harvest periods of these fruits extend through all of the months of the year, with Chinese gooseberries and tree tomatoes ripening during the winter and loquats in spring, when strawberries follow on and lead in the summer-fruiting kinds, which are the most numerous. Most of these fruits have distinct commercial possibilities under the right conditions. Mulberries, however, are too perishable for shipment, and *Myrtus ugni*—here called a cranberry and elsewhere the Chilean guava—is more often grown as an ornamental shrub; but its aromatic fruits are edible, and a handful or so in an apple-pie give it a spiced flavour that is agreeable to most people. It is related to the tree which produces the cloves of commerce, and has sometimes been called *Eugenia ugni*.

Where commercial plantations of any of these fruits are to be made, the land should be taken in hand so soon as it is available and thoroughly prepared for planting during the autumn, winter, or spring, as the case may be. As these crops are perennial, and most of them have fibrous roots near the surface of the ground which prevent deep cultivation after establishment, it is necessary to eradicate completely any bad weeds, such as couch-grass, which may be present. The land should be cultivated deeply, and, especially in the case of land inclined to be poor, it should be enriched generously by turning in organic material to supply humus. Unsatisfactory crops are due chiefly to the presence of bad weeds or to maintaining the plantation when the plants are worn out and exhausted—a condition which is generally reached after a period of eight or ten years, if not before. Dry summer weather affords an excellent opportunity for cleaning the land, after which a good green crop or dressing of farm manure turned under will put the land into good heart for planting. So soon as planting is done, especially when it is in close order as with strawberries, the operation of implements is restricted; therefore the ground should be cleaned well before planting, when doing this is easier, cheaper, and more effective. Meanwhile definite plans for planting should be decided on and good plants located and ordered for delivery as soon as the season permits.

Plantations which have ceased to be profitable should be grubbed and burned or ploughed under as soon as the harvest is completed. At this season in many instances it would be advisable to plant a crop of broccoli, cauliflower, or a green crop to plough under later. Plantations which are to be continued are given what attention may be required. Raspberries and loganberries are pruned by removing all of the old growth which bore this season's crop. It is cut away at the surface of the ground, carried out, and burnt, treatment which is of the greatest service in pest-control when it is done thoroughly. Towards the end of January, when growth has ceased, black-currants also are pruned by cutting away the old wood, severing it just above a bud near the base. Where strawberries are to be carried on, old leaves and runners are removed and the plantation given such manurial dressing as may be necessary and light cultivation to put the plants into good condition, without making them soft and liable to suffer during the winter.

The Homestead Garden.

The work of planning a garden to scale is a comparatively simple matter if the different features are dealt with in the right order. It is advisable to take a sheet of "graph" paper with the surface divided faintly into squares, ten to the inch; to call each square a foot and to work to a scale of 10 ft. to the inch. A ground-plan of the home should be drawn to scale; then an outline of the homestead section in its right relation to the house. Following on comes the service court, drive, and walks for access, which are placed in convenient positions for their purpose. All of these features are practically fixed in most instances and allow of little difference of opinion, as also does a fairly generous portion of land, more or less rectangular in shape, which is set aside as an enclosed garden for perennial crops such as asparagus, rhubarb, herbs, and small fruit only—an interesting and very useful feature. The remainder of the design now makes some demand on the imagination; much also depends on whether the land is flat or hilly, and the tastes and requirements of the household.

The larger area of ground usually lies to the north of the house, the direction of the noonday sun, and is sown down in lawn-grass and planted with a few specimen trees or shrubs, and so the house is kept open to the sunlight. The land to the south of the dwelling is usually occupied with shelter-trees or a plantation of a suitable size for the conditions. That to the east and west is bounded by shelter-hedges that are lower and furnished on the garden side with shrubberies which have a semi-shaded aspect which suits so many kinds of shrubs. Within this scheme a group of rose-beds and a herbaceous border may well find a place. These and other features, together with a variety of levels and situations, as well as extent, provide a field for designs of an infinite diversity. There is also the question of climate, which varies widely in rainfall and temperature, as well as soil. The planting to be most effective should be confined to plants which are absolutely characteristic of those conditions. This will give the work character and interest and get rid of the monotony which may and does sometimes creep into garden-planning.

The planting is planned by marking off the shrubbery border at intervals of 6 ft., making them sometimes 3 ft. towards the front of the border. These are about the average distances at which the larger and smaller shrubs respectively are set. Groups of these marks are surrounded by a line which also includes a number, which corresponds with a number against a plant in a numbered list of shrubs. In this way the number of plants of one kind in a group and their exact position are clearly indicated. Large trees may be numbered without grouping; and the herbaceous border in the plan may have the groups shown without the marks indicating the exact planting-position, as they vary widely. In this way borders on the plan are marked off into numbered groups, and trees and hedges shown on the plan are also numbered, the corresponding number in each case being placed before the name of a plant in the planting-list.

Large gardens are best planned and made by landscape architects who have had long experience of the work. In the moderate-sized garden, owners who are specially interested often desire to do the work themselves, but, in that case, after planning the work along the lines explained above, it would be advisable to submit it to an experienced person for well thought-out constructive criticism before proceeding with the work. The problem is comparatively simple in the case of the average small garden, in which, if planned and executed on the principles explained here, greatly improved results will generally be obtained.

—*W. C. Hyde, Horticulturist, Wellington.*

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison :—

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1935 ..	9,697,231	83·68	8,114,361	..
1934 ..	9,524,065	88·70	8,447,643	8,555,477
1933 ..	9,318,943	91·23	8,502,050	8,385,569
1932 ..	9,170,996	89·16	8,177,657	7,988,569
1931 ..	9,247,005	86·49	7,998,247	7,813,887
1930 ..	9,312,461	83·19	7,747,274	7,710,370
		SOUTH ISLAND.		
1935 ..	8,115,186	39·45	7,259,281	..
1934 ..	8,047,361	89·88	7,232,750	7,134,015
1933 ..	7,890,756	88·14	6,955,252	6,889,128
1932 ..	7,892,064	88·42	6,978,494	7,027,059
1931 ..	8,361,724	87·13	7,285,914	7,161,104
1930 ..	8,251,714	84·43	6,967,041	6,817,939
		DOMINION.		
1935 ..	17,812,417	86·31	15,373,642	..
1934 ..	17,571,426	89·24	15,680,393	15,689,492
1933 ..	17,209,697	89·82	15,457,302	15,274,697
1932 ..	17,063,060	88·82	15,156,151	15,015,628
1931 ..	17,608,729	86·79	15,284,161	14,974,991
1930 ..	17,564,175	83·77	14,714,315	14,528,309

District Estimates.

The following table gives estimates of the current (1935) season's lambing for the several sheep districts :—

Sheep District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland	1,990,732	81·22	1,616,884
Gisborne - Hawke's Bay ..	3,940,495	82·32	3,243,858
Wellington - West Coast ..	3,766,004	86·39	3,253,619
Marlborough-Nelson-Westland	786,122	78·41	616,324
Canterbury-Kaikoura ..	3,442,048	90·46	3,113,903
Otago (including Southland) ..	3,887,016	90·79	3,529,054
Dominion	17,812,417	86·31	15,373,642

—*Live-stock Division.*

According to a report from the Instructor in Agriculture, Invercargill, three Southland farmers who last season grew trial areas of Mai turnip are pleased with it in respect to its resistance to club-root, but find that its yield is somewhat low.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF LACERATED TEAT.

F. E. C., Otaki Railway :—

Barbed wire ripped a teat through to the milk channel from base to point. Though the teat was bound with sticking-plaster and a teat-syphon used milk oozed between the cut parts ; they have healed separately and the teat has opened out flat. Can anything be done while the animal is dry to make the wound heal together properly ? The sphincter muscle at the point of the teat has been cut through, so that, even if the teat could be healed, probably milk would always be leaking away. Can anything be done to dry off the bad quarter altogether so that it will not produce milk ?

The Live-stock Division :—

As the injury to the teat in question has been a severe one, one cannot recommend any measures which are now likely to bring about a sufficient degree of repair to enable the teat to function in a satisfactory manner. Openings and leaking of milk from the quarter are liable to occur even after an operation has been performed. Moreover, the possibility of the quarter becoming affected with mammitis during or following the operation is considerable Injections of alum and boracic powder in water will assist in drying off the quarter. It is difficult to prevent the quarter secreting milk when the cow flushes again, as to do so would practically mean the destruction of the secreting tissue of the quarter. The secretion may be controlled by the use of an astringent solution of alum and boracic powder, and the quarter may be eventually dried off. This should be your ultimate aim, so that the cow may be milked from three sound quarters.

STORAGE FOR BALED HAY.

A. A. M., Norsewood :—

What is the size of shed needed to hold the baled hay from about 6 acres ?

The Fields Division :—

On your country 6 acres of pasture should yield about twelve tons of hay. When baled this could be stored in a space about 10 ft. high, 12 ft. broad, and 20 ft. long. Generally it is considered unnecessary to provide weather-boarded sides on a building for this purpose, and the usual practice is to build what is known as a " Dutch barn " This consists simply of an iron roof supported on uprights, and for a shed of the above size six uprights should suffice.

SURFACE SOWING OF PASPALUM AND SUBTERRANEAN CLOVER ON BURN.

T. W. N., Bulls :—

I wish to establish paspalum and subterranean clover on a scrub burn on which the " take " of ordinary pasture has not been satisfactory. Would surface sowing on non-arable land be successful, and, if so, what is the best time for sowing for South Auckland District ?

The Fields Division :—

Surface sowing of paspalum and subterranean clover on non-arable land is quite successful provided there is plenty of ash remaining after the burn. It is probable, however, in your case that the ash has already disappeared, and if this is the case it is necessary to break up the surface of the ground by disking or hard harrowing.

The paspalum, to obtain the best results, should be sown in the spring, probably before the end of November. The following should be a suitable mixture to the acre : 10 lb. paspalum and 5 lb. subterranean clover. After sowing it is advisable to apply a dressing of 2 cwt. to 3 cwt. of superphosphate to the acre.

Provided the crust of the ground is broken, some establishment may be expected, but if the ground is hard or carrying anything of a fibrous mat of unburnt vegetation much success is not to be expected. In this latter case probably *Lotus major* should be included at the rate of 1 lb. to 2 lb. of the seed to the acre.

WEATHER RECORDS: NOVEMBER, 1935.

Dominion Meteorological Office.

NOTES FOR NOVEMBER.

As a spring month November proved very disappointing, the outstanding meteorological features being its coldness, a deficiency of sunshine, and, in most districts, an excess of rainfall. Although there was fairly abundant growth, lambs did not fatten as well as might have been expected at this season of the year. In dairying districts the milk-yield was below normal. The constant showery conditions also interfered considerably with shearing operations. On the whole, however, stock kept in good condition, and the summer prospects for the farming community appear to be in every way propitious.

Rainfall.—The general rainfall exceeded the average over the greater part of the North Island, slight deficiencies being experienced in parts of the Auckland district and the Taranaki Bight only. The rainfall was above normal also over the eastern half of the South Island, but below in the western half.

Temperatures.—Temperatures were below the average over the whole Dominion, and, in fact, the November just passed proved, in many parts, to be one of the coldest on record.

Pressure Systems.—During the first week moderate to strong winds between north-west and south-west prevailed. The weather was rather changeable, and what rain fell was chiefly of a showery and scattered nature. On the night of the 6th, however, a strong southerly wind set in generally, accompanied by fairly widespread rain and a decided drop in temperature. A few high-level stations in the South Island at this time experienced falls of snow, while there were hail showers on parts of the eastern and southern coastal areas. Cold, squally conditions continued throughout the 7th and 8th.

On the 9th fine weather was experienced in most districts except in North Auckland, where strong westerly winds with showery conditions continued to prevail. On the 10th the weather became dull and threatening, with scattered rain, and during the night of the 11th widespread rain accompanied a southerly change. Cold, wintry-like conditions continued until the morning of the 14th, but an improvement was then setting in over most of the country, and, under the influence of a slight anticyclone, beautifully fine and warm weather prevailed on the 15th and 16th.

On the 17th dull, misty weather prevailed generally, rain developing in most districts, with fresh to strong north-easterly to northerly winds. During the night of the 17th heavy rain fell in many parts of the North Island and in the northern and west-coast districts of the South Island. Scattered falls occurred on the two following days, but by the morning of the 20th the weather had improved in the South Island. By the 21st the weather had become fine and pleasant generally, with milder temperatures.

By the night of the 23rd the front of a westerly depression had moved on to the Dominion, bringing scattered rain to western areas, and during the night of the 24th rain became more widespread, the wind turning to southerly in the South Island. This depression intensified when off the east coast, and on the 25th and 26th strong south-westerly winds blew in most parts of the country, the weather being particularly cold on the latter day, but in Westland it was mainly fine. Snow fell on many of the ranges of both Islands during the night of the 25th and on the 26th, and hail showers occurred in some of the coastal areas.

From the 27th to the close of the month the weather was generally fine, while an anticyclone moved slowly over the Dominion, but on the 30th dull, misty conditions prevailed in the Cook Strait area and on the west coast of the South Island.

RAINFALL FOR NOVEMBER, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	[illegible]
Kaitaia	4·29	20	2·03	2·75	66·18	[illegible]
Russell	2·63	10	1·43	2·22	88·10	[illegible]
Whangarei	3·25	18	0·97	2·81	76·35	[illegible]
Auckland	3·43	19	1·05	3·59	58·14	46·17
Hamilton	4·15	21	[illegible]	4·01	46·22	46·04
Rotorua	[illegible]	19	2·05	4·18	66·34	51·25
Kawhia	[illegible]	12	1·86	4·52	..	50·42
New Plymouth ..	4·05	21	0·96	4·70	72·29	55·49
Riversdale, Inglewood ..	6·90	18	1·37	9·12	110·53	96·69
Whangamomona ..	7·04	18	1·51	7·39	82·35	71·92
Hawera	4·40	17	0·61	3·78	54·76	41·96
Tairua	2·61	12	1·16	3·63	69·72	60·07
Tauranga	3·37	19	1·03	3·29	60·56	48·81
Maraehako Station, Opotiki	..	..	..	3·16	..	50·45
Gisborne	4·54	16	1·22	2·88	45·61	42·83
Taupo	5·26	18	0·95	3·32	51·72	40·75
Napier	3·33	15	0·72	2·02	49·76	28·14
Hastings	2·63	16	0·40	1·82	38·76	29·98
Whakarara Station ..	5·26	17	0·85	..	61·87	..
Taihape	4·88	21	0·63	3.40	36·52	33·46
Masterton	4·04	14	0·90	2·69	44·04	35·47
Patea	5·68	22	1·37	4·01	55·37	41·29
Wanganui	3·03	16	0·72	3·24	41·45	33·42
Foxton	2·00	14	0·32	3·20	34·33	29·87
Wellington	2·84	18	0·58	2·99	37·65	39·37
South Island.						
Westport	8·04	19	1·51	8·85	84·81	88·35
Greymouth	6·17	15	1·04	9·10	87·10	92·90
Hokitika	9·54	16	2·84	10·45	100·84	104·57
Ross	10·80	13	3·48	13·86	106·44	123·44
Arthur's Pass ..	7·71	13	3·51	16·11	116·68	147·80
Okuru, South Westland	..	..	..	12·60	..	133·50
Collingwood	9·08	13	4·66	6·90	97·46	89·19
Nelson	3·14	11	1·93	2·92	44·27	34·86
Spring Creek, Blenheim	2·59	13	1·25	2·39	27·30	28·18
Seddon	2·16	11	0·76	1·85	22·13	22·84
Hanmer Springs ..	6·12	20	1·46	3·46	42·15	41·29
Highfield, Waiau ..	4·68	16	1·00	2·52	31·69	30·64
Gore Bay	4·18	15	0·76	2·12	26·93	28·70
Christchurch	2·88	15	0·54	1·78	21·55	22·67
Timaru	3·48	14	0·57	1·95	19.29	20·26
Lambrook Station, Fairlie	3·50	12	0·89	1·93	20·81	22·30
Benmore Station, Clearburn	3·34	16	0·82	2·05	21·55	22·30
Oamaru	2·12	14	0·30	1·92	17·92	19·76
Queenstown	..	..	..	2·71	..	27·99
Clyde	1·04	9	0·29	1·34	13·63	13·46
Dunedin	3·78	18	0·63	3·21	33·69	33·18
Wendon	3·32	15	0·67	2·72	29·69	27·14
Balclutha	[illegible]	13	0·50	2·48	28·64	23·06
Invercargill	3·10	19	0·53	4·28	42·26	41·65
Puysegur Point ..	4·68	18	0·68	8·25	77·08	78·09
Half-moon Bay ..	2·87	16	0·72	5·79	53·67	53·89